Vol. XXXVI, No. 1, 2011

CUK-H06303-14-KP2868.

Man and Environment

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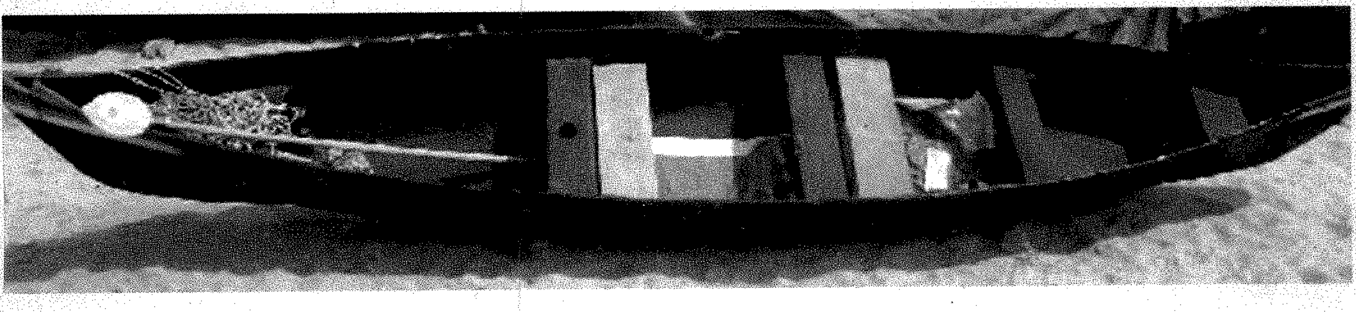

Indian Society for Prehistoric and Quaternary Studies

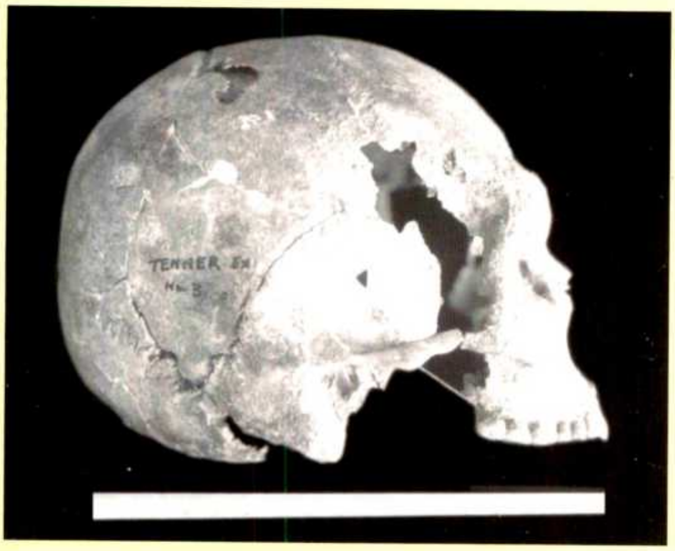

Fig. 24: Tenneru: No. 3/70, cranium, right lateral aspect

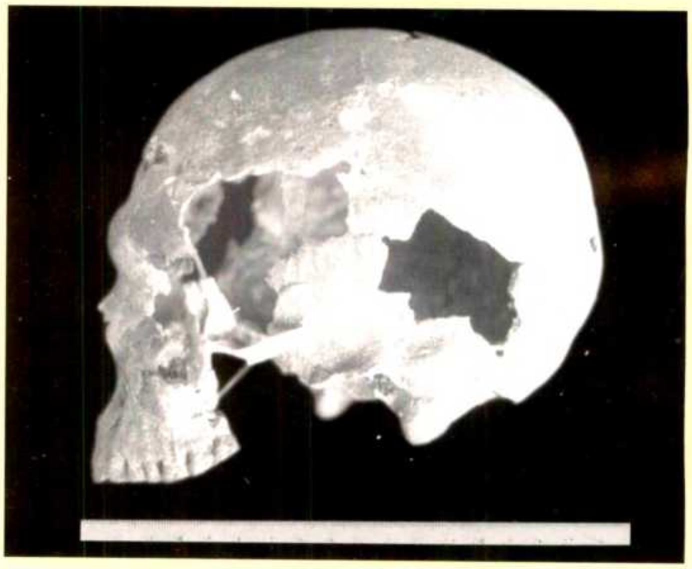

Fig. 25; Tenneru: No. 3/70, cranium, left lateral aspect

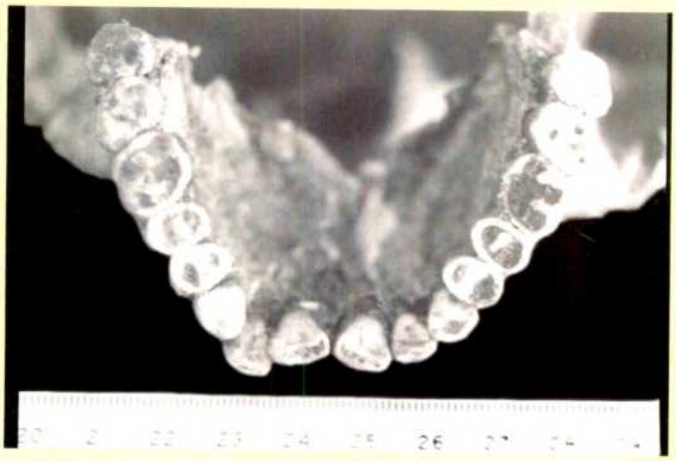

Fig. 26: Tenneru: No. 3/70, palate, inferior aspect

UNIVERSITY OF CALCUTTA
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Man and Environment

Journal of the Indian Society for Prehistoric and Quaternary Studies

Editor: V.N. Misra

Joint Editors: P.P. Joglekar
Shanti Pappu
Associate Editor: Arun Sinha

Editorial

This issue of the journal contains eight articles and two book reviews. This issue has more contributions about megalithic and ethnoarchaeological studies. S.R. Walimbe, P.C. Caldwell-Ott and K.A.R. Kennedy report a study of human skeletal material from hitherto undescribed megaliths from South Asia. Veena Mushrif-Tripathi and Tiatoshi Jamir present a study of two skeletons from Leshmi, a megalithic site in Nagaland. This study is useful for understanding the rituals associated with Iron Age megaliths. Srikumar Menon and his colleagues report new discoveries of stone alignments and megalithic burials from Karnataka. Other contributions on this theme are V. Vinod and K. Krishnan's article on specialization among the potters around the Harappan site of Bagsara,and study of traditional boats of Goa by Zeeshan A. Shaikh and his colleagues.

K. Paddayya has made an objective assessment of the contribution of the path-blazing archaeologist, the late F.R. Allchin, to South Asian Archaeology, with special reference to southern Deccan, the principal arena of his field studies. V.N. Misra has contributed revised text of his Professor H.D. Sankalia Memorial Lecture delivered at the Annual ISPQS Conference at Allahabad in December 2009

We again note with concern, what we have done before, the scarcity of contributions on prehistory proper and Quaternary Studies, which are the main areas of the journal. It becomes difficult to find even a handful of presentations during the Annual Conference of the Society on prehistory and allied Quaternary studies. This reflects the declining interest and standard of teaching and research in prehistory. We sincerely hope that young archaeologists would take interest in these two fields and conduct research pertaining to our prehistoric past.

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The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and the Archaeological Survey of India (ASI). *The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR, ASI and the Indian Society for Prehistoric and Quaternary Studies accept no responsibility for them.*

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The Society publishes its bi-annual Journal (June and December) *Man and Environment*. This journal publishes recent and *original* research in the field of South Asian archaeology, including related topics in environmental, anthropological and historical disciplines. The journal has five types of contributions: research articles, short notes, review articles, obituaries, and seminar and conference news. Books are welcome for reviews. The editors will send the book to suitable scholars to be reviewed. All articles submitted for publication are sent to referees. Authors will be asked to revise their manuscripts in the light of these comments. Acceptance of the manuscript will mainly depend on the opinion of the referees.

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Contributors should send two sets of the manuscript (including figures and tables) along with an electronic copy of the paper in Microsoft Word on a CD. Please mark the CD with your name, and the name of the software programmes you have used for the manuscript and the figures. The manuscript and electronic copies should be addressed to Dr. P.P. Joglekar, c/o Department of Archaeology, Deccan College, Pune 411 006, India.

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Cover: Extended dugout without outrigger

Mishar V.N., *Man and Environment* XXXVI(1): 1-13 [2011].
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Contribution of Professor Hasmukh Dhirajlal Sankalia to Mesolithic Studies in India*

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Introduction

I am deeply thankful to the Executive Committee of the Indian Society for Prehistoric and Quaternary Studies ((ISPQS) for asking me to deliver the prestigious H.D. Sankalia Memorial Lecture during the joint Annual Conference of the Indian Archaeological Society (IAS), ISPQS, and Indian History and Culture Society (IHCS), being held under the auspices of the Department of Ancient History, Culture and Archaeology, University of Allahabad. I apologize for my inability to present my talk in person due to health reasons. I consider myself extraordinarily fortunate to have had a scholar and teacher of Prof. Sankalia's stature as my mentor. I feel extremely happy to pay this humble tribute to him.

I accepted the invitation because Prof. Sankalia was my teacher. I learnt archaeology from him not only as my Ph.D. supervisor but also in the field and as his colleague. Sankalia was a teacher *par excellence.* As he has said in his autobiography, *Born for Archaeology*, he not only taught and researched archaeology but lived it every wakeful moment. While walking he would carefully watch every pit and cutting, and if he noticed anything interesting like a gravel deposit or a soil layer, he would descend into the pit or go close to the section and observe it minutely. If he had read some news, article or book which he thought would be of interest to a colleague or student, he would go to the room of the person concerned or send for him and tell him about it. On several occasions he chided me for spending, like Subbarao, too much time on reading newspapers and magazines. If I have succeeded in making some modest contribution to Archaeology, it is only because of the inspiration and guidance I received from Prof. Sankalia.

My Interest in the Study of the Mesolithic

Archaeology of the Mesolithic period had been my major research interest from the beginning of my academic career. I wanted to do my Ph.D. on the Mesolithic of Mirzapur district, Uttar Pradesh (U.P.) because I had read of A. C. L. Carlleyle's work in the publications of V. A. Smith (1906), Bridget Allchin (1958), and G.de G. Siveking (1960). I was also familiar with Sankalia's work on the Mesolithic of Gujarat, having read the article, 'Early Primitive Microlithic Culture and People of Gujarat' by him and Irawati Karve in the *American Anthropologist.* I had also read *Mesolithic Age in Britain* and *Mesolithic Settlement of Northern Europe* by J.G.D. Clark, the foremost authority on the Mesolithic.

However, when I went to Pune in June 1958 and told Prof. Sankalia about my ideas, he advised me against working in Mirzapur, by telling me that Prof. G.R. Sharma of Allahabad University was already working there and he did not want any misunderstanding with him; instead he advised me to work in Rajasthan which was a *terra incognita* as far as prehistory was concerned.

Absence of Hiatus between Palaeolithic and Neolithic in French Cave Deposits

As at no place in Europe a continuous succession of cultures from the Palaeolithic to Neolithic was found, it was widely believed that there was a cultural discontinuity or hiatus between these periods. In the French caves, there was always a sterile deposit between the Palaeolithic and Neolithic, denoting a cultural break or gap. At that time it was believed that agriculture originated in the Near East and was introduced into Europe by farmers from Asia. This was the reason for the stratigraphic gap between the Palaeolithic and Neolithic.

Recognition of Mesolithic Stage in the Indian Stone Age

The existence of a Stone age in human history was recognized in the nineteen-thirties by the discovery of chipped stone tools in association with fossilized bones of extinct animals in the geological deposits of the Somme river at Abbeville in France by Jacques Boucher de Crevecoeur de Perthes. Although ground stone tools, belonging to a later age, had been collected from the surface at many places in India and Europe from a much earlier date, they were almost always unassociated with other cultural remains. However, around 1854 remains of ancient dwellings, pottery, ground stone implements, bones of domesticated animals, and charred seeds of cultivated plants, were found on the floor of several Swiss lakes. Archaeologists realized that these finds represented a younger and different stone age. The French prehistorians gave descriptive names of *l'age de la pierre tailee* (the age of chipped stone), and *l'age de la pierre polie,* (the age of polished stone) to these two stages. Later, in 1865, the British amateur archaeologist, Sir John Lubbock, coined the terms Palaeolithic and Neolithic, for these stages in his book, *The Prehistoric Times.*

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* Professor H.D. Sankalia Memorial Lecture (in absentia) during the XXXVII Annual Conference of the Indian Society for Prehistorical and Quaternary Studies, University of Allahabad, Allahabad, 14th November 2009.

Discoveries by A.C.L. Carlleyle, an Assistant of Sir Alexander Cuningham, founder Director-General of the Archaeological Survey of India (ASI) in rock shelters in the Vindhya Hills of Central India in the late sixties of the nineteenth century revealed abundant quantities of microlithic tools which were different from both Palaeolithic and Neolithic tools and supposedly belonged to a stage between them. Carlleyle realized that there was no break or hiatus between the Palaeolithic and Neolithic and coined the term Mesolithic/Mezolithic for this transitional stage.

Mesolithic is a brief period, with its duration ranging from a few centuries or millennia in the Near East to some thirty-five millennia in Sri Lanka. The technological hall mark of this period is tiny stone tools or `microliths'. This much-abused term is strictly to be applied only to tools made on microblades or bladelets or occasionally on small flakes, of which one or more margins have been blunted by steep retouch. The microliths comprise non-geometric forms like rectangular blunted back blades and points, and geometric forms like crescents or lunates, triangles and trapezes. These artefacts were too small to be used individually; instead, they were used as components of tools and weapons by being hafted in bone, antler, wood or reed handles and shafts. A groove was cut in the handle or shaft and a number of microliths were arranged serially into it and glued together by a natural adhesive like gum or resin. Microblades were blunted to prevent damage to the haft by their sharp edge, and thereby loosening them during use. Microliths were used as tips and barbs of arrowheads and spearheads and as cutting edge of knives, sickles, daggers and harpoons. Discoveries of hafted microliths from many excavated sites in Europe, the Near East, Africa and India, as also their depiction in hafted tools and weapons in central Indian rock shelter paintings, testifies to their use in this manner (Misra 1974).

Emergence of Agriculture

Utilizing the intimate knowledge of animal and plant behaviour, accumulated by their Palaeolithic ancestors during the preceding two million years, the Mesolithic people started animal domestication and plant cultivation around nine thousand years ago in the vast stretch of land lying between the east coast of the Mediterranean and the western margin of the Indus plain in Pakistan. The knowledge and practice of agriculture was diffused through the medium of the Mesolithic people over much of the Old World. It is the Mesolithic people who became the pioneering farmers, and their descendants established permanent settlements or villages which slowly grew into towns and cities. The descendants of the Mesolithic people eventually invented civilization around five-and-a-half thousand years ago.

It is remarkable that despite the nine thousand year old history of agriculture, the atavistic hunting-gathering way of life is persisting in many parts of the world, including India, right into the twenty-first century. Both farmers and hunter-gatherers have made a significant contribution to the evolution of the uniquely Indian social phenomenon of caste.

Distinctiveness of the Mesolithic Period

For a variety of reasons evidence for the Mesolithic period in India is far richer than that for the Palaeolithic. First, majority of the dated Mesolithic sites belong to the Holocene and they are fairly well preserved. Secondly, over two thousand sites of this period have been discovered in the country, barring a few parts. Thirdly, over thirty sites have been excavated in varying scales and they have provided a variety of cultural materials which throw light on the technology, material culture, subsistence, and disposal of the dead. Fourthly, biological material, comprising animal and human skeletal remains, is preserved in good quality and quantity at a number of sites. Fifthly, eight excavated sites have yielded human skeletal remains. Barring the solitary

Pleistocene human cranium and clavicle finds from Hathnora in the Narmada valley, these are the oldest human skeletal remains found in the country. Their study by biological anthropologists has thrown valuable light on methods of disposing of the dead, biological composition of contemporary human populations, dietary habits, pathology and social organization of the Mesolithic communities. Sixthly, there is an abundance of rock paintings, associated with Mesolithic sites, which complement other archaeological data for reconstructing technology, economy, social organization and religious beliefs and practices of the Mesolithic populations. And finally, over fifty radiometric dates from several sites help in determining their antiquity, and in understanding the process of evolution of Mesolithic societies.

Brief History of Mesolithic Research in India

Work of A.C.L. Carlleyle

Microliths, the most distinctive component of Mesolithic technology, were discovered in India as early as 1867-68 by A.C.L. Carlleyle in the rock shelters of the Vindhya Hills. Subsequently, in 1880-81, Carlleyle excavated some of these shelters and came across microliths and other stone tools, living floors with hearths containing animal bones, ash and charcoal, and human burials. On the walls and ceilings of the shelters Carlleyle noticed paintings which appeared to him "to illustrate in a very stiff and archaic manner scenes in the life of the ancient stone chippers; others represent animals or hunts of animals by men armed with bows and arrows, spears and hatchets" (Smith 1906: 187). John Allen Brown (1889, 1892) published two articles, documenting the widespread occurrences of microliths, including Carlleyle's discoveries. Carlleyle (1883) published only a one page note on his finds. His hand-written notes fortunately reached his friend, Reginald Gatty who passed them on to Vincent Smith, a noted civil servant and historian, who published an article on them (Smith 1906). Others who wrote about Carlleyle's work are Bridget Allchin (1958), G. de G. Sieveking (1960), L.R. Binford (1968), and Cook and Martingell (1994). These are the main sources of our information about Carlleyle's work. His collections of microliths and associated artefacts found their way into several museums in Europe and the United States. For his precocious discoveries Carlleyle's name will live forever.

Work of Robert Bruce Foote

Carlleyle's contemporary, the well-known geologist, Robert Bruce Foote, discovered many microlithic sites in different parts of South India and in Gujarat, including the now famous site of Langhnaj, in the last three decades of the nineteenth century. Unlike Carlleyle though, Foote studied his collections of palaeoliths, microliths and other antiquities very meticulously and published detailed accounts of them, illustrating his finds with photographs and line drawings (Foote 1914, 1916). Among other contemporaries of Carllelyle were Black (1892), J. Cockburn (1888) and H. Rivett-Carnack who made discoveries of stone tools and rock paintings, the latter illustrating scenes from the life of stone tool makers and users

Foote's Successors

Foote's work was continued by some civil servants in the twenties and thirties of the twentieth century and by professional prehistorians thereafter. L.A. Cammiade, a civil servant collected palaeolithic and microlithic tools from the alluvial sediments in the Eastern Ghats. His collections were examined by the Cambridge University archaeologist, M.C. Burkitt, and together they published an account of them in *Antiquity* in 1930. Small-scale diggings of microlith-bearing deposits were carried out by G.R. Hunter (1935-36) and D.H. Gordon (1938, 1950) in the rock shelters at Pachmarhi in the Mahadeo Hills in Madhya Pradesh. The only professional prehistorians of this period were A. Aiyappan of the Anthropology Department of Madras University, D. Sen of Anthropology Department of Kolkata University and V.D. Krishnaswami of the ASI.

Contribution of H.D. Sankalia

Like Bruce Foote, Sankalia was also a pioneer in prehistory, and contributed, both by his own work and that of his students, more to our knowledge of the Mesolithic, indeed of prehistory as a whole, than anyone else before or after him. In addition to his considerable personal research, Sankalia trained and inspired a large number of young researchers at the Deccan College as well as in other institutions in the country to pursue research in prehistory.

Significant advance in our knowledge of the Mesolithic period was made only when Sankalia undertook excavation at Langhnaj and other sites in Gujarat in the early forties of the last century.

Sankalia's Training in Archaeology

Sankalia was trained in archaeology in England. He participated in the excavation at the Roman site of Maiden Castle being conducted by the distinguished archaeologist, R.E..M Wheeler of the Institute of Archaeology, London University. Here he learnt techniques of excavation and principles of stratigraphy. Another teacher of Sankalia, F.J. Richards, a former member of the Indian Civil Service and protaganist of geographical approach to study of the past, taught him value of geography in the study of history, particularly study of place and personal names mentioned in inscriptions and texts for reconstructing cultural history. During this period Sankalia also happened to read the almost forgotten two volumes on Indian prehistoric and protohistoric antiquities by geologist, Robert Bruce Foote, father of Indian Prehistory, and took copious notes from them. From these volumes Sankalia taught himself prehistory, which later became, in his own words, his life work. While on a trip to India in 1935 to collect material for his Ph.D. thesis, Sankalia participated, on the recommendation of Father Henry Heras, in Ernest Mackay's excavation at the Harappan site of Chanhu-daro in Sind. This gave him further experience of excavation techniques, knowledge of protohistory, and ability for interpretation of excavated materials.

Sankalia completed his Ph.D. thesis on the Historical Archaeology of Gujarat in 1935 under the guidance of Professors K.D.B. Codrington and F.J. Richards. While in London, Sankalia took detailed notes from Bruce Foote's volumes and learnt to identify stone tools of different periods by comparing descriptions with illustrations in the volumes and by examination of actual tools in the museums of London University and School of Oriental and African Studies. He decided to follow up Foote's work on his return to India in 1936.

Combination of Sankalia's unusual determination, perseverance, and good luck.

Sankalia's appointment as Professor of Proto and Ancient Indian History at the newly reopened Deccan College as Post-Graduate & Research Institute, provided him a god-sent opportunity to realize his dream of pursuing Bruce Foote's work in Gujarat. To add to Sankalia's good fortune, in 1940 Rao Bahadur K.N. Dikshit, then Director General of the ASI, visited the Deccan College. Sankalia met the Rao Bahadur and told him about his intention of pursuing Bruce Foote's work in Gujarat. He requested the Rao Bahadur to provide him facilities for an expedition to Gujarat. Sankalia's demands comprised funds for meeting the cost of labour for field work, two qualified colleagues, and modest camp equipment of three tents and furniture. To Sankalia's unending good luck, Dikshit promptly accepted all his demands. Besides funds and camp equipment, Dikshit gave him two officers, namely V.D. Krishnaswami, prehistorian of the ASI, and B.K, Chatterji, a physical anthropologist of the Anthropoloical Survey of India.

The team led by Sankalia re-examined all the palaeolithic and microlithic sites, namely Pedhamali, Akhaj, Valasana, and Langhnaj, discovered by Bruce Foote in the Sabarmati and Mahi valleys, and chose Langhnaj in Mehsana district for excavation. He could not have been luckier in his choice.

Excavations at Langhnaj

Langhnaj was the first Mesolithic site to be excavated in India. It is located on one of the numerous low sand dunes dotting the alluvial plain of north Gujarat. Almost always a group of dunes cluster around a depression which receives the runoff from the surrounding dunes and retains water, often up to the beginning of the monsoon. Sankalia excavated the site on several occasions between 1941 and 1946. He encountered microliths, bits of hand-made pottery, charred animal bones, and, most important, skeletons of intentionally buried humans. These were the first Stone Age skeletons to be discovered in India after Carlleyle's finds in Mirazpur shelters, made almost eight decades earlier and too fragmentary and fragile for retrieval for want of techniques and experience.

Contribution of Irawati Karve and G.M. Kurulkar

Immediately after making his discoveries, for the scientific study of the skeletal remains Sankalia enlisted the cooperation of two biological anthropologists, Irawati Karve, his colleague at the Deccan College, and G.M. Kurulkar, Professor of Anatomy at the Govardhandas Medical College in Mumbai. Sankalia published several articles on the finds, particularly microliths, in journals in India and England, articles as well as brochures on human burials and their anthropometric study. The seminal paper, Early Primitive Microlithic Culture and People of Gujarat, written jointly by Sankalia and Irawati Karve, continues to be referred to even today.

Contribution of F.E. Zeuner, Juliet Clutton-Brock, Sophie Ehrhardt, and Kenneth A.R. Kennedy

In 1949, on the advice of Sir Mortimer Wheeler, former Director General, ASI, Sankalia invited F.E. Zeuner, the well-known expert on Quaternary climate and environment, at the Institute of Archaeology, University of London, to examine the possibility of the presence of a buried soil horizon in the sand dune deposit at Langhnaj. Zeuner succeeded in locating a faint soil horizon within the dune. He also examined the microlithic industry and faunal remains from the site. After examining the bruisings on a rhinoceros shoulder blade from Langhnaj, Zeuner drew the inference that the bone had probably been used as an anvil for producing microliths.

Zeuner took the faunal collection from Langhnaj with him to London where it was studied by his student, Juliet Clutton-Brock. The study was published as a monograph by the Deccan College (Clutton-Brock 1965). On Sankalia's request the human skeletal remains from Langhnaj were studied by German and American anthropologists, Sophie Ehrhardt and K.A.R. Kennedy. This study was also published by the Deccan College as a monograph (Ehrhardt and Kennedy 1965).

The study of 14 skeletons from Langhnaj indicated that the hunter-gatherer-fisher folk betray mixed racial features: dolichocephalic head with fairly large cranial capacity, medium and long stature with thin legs due evidently to continuous movement, pronounced supraorbital ridges, and a slight prognathism of the mouth and probably a snub nose. The highly ground surface of the crown of the teeth suggests a coarse diet. All these features betray mixed Mediterranid and Veddid features, but not of any particular racial stock (Ehrhardt and Kennedy 1965: XV).

Excavation at Sangankallu

In mid 1960s Sankalia excavated the Mesolithic deposit at Sangankallu in the Bellary district of Karnataka. Here, unlike at Gujarat sites, where stone tools were made of quartz and chert, the Mesolithic industry was made of basalt flakes, blades and scrapers, chert microblades and non-geometric microliths.

In addition to his personal research, Sankalia inspired a large number of young researchers at the Deccan College as well as in other institutions in the country to pursue research in prehistory.

Work of Sankalia's Students

Sankalia was a pioneer of Indian prehistory. When he began his career in 1939, there were only a couple of prehistorians in the country–Dharani Sen in the Anthropology Department of Calcutta University, and V.D. Krishnaswami, in the ASI. Barring the work of Robert Bruce Foote in South India and Gujarat, no region of the country had been systematically explored for prehistoric remains. Acutely aware of this lacuna, Sankalia encouraged his Ph.D. students to take up regional surveys of archaeological sites as research topics. The principal aims of these surveys were: (a) systematic exploration of the valleys of individual rivers and their tributaries, and search for stone artefacts on the surface, and in the deposits along their banks; (b) measure the size of the area of artefact distribution on the surface, divide it into a grid of squares of uniform size, determined by the density of artefacts, and carefully collect all the artefacts from randomly selected squares, record the number of artefacts in each square; and (c) the sequence of strata in the deposits along the banks on the basis of their geological composition, colour, and compactness, and collect artefacts from individual strata, according to their vertical and horizontal distribution, record their stratigraphic position, and number them. This was the model which had been followed in Europe and Africa in the early stages of research. As a result of this carefully thought out programme, several regions of the country were systematically explored, and a large number of prehistoric sites of Palaeolithic, Mesolithic, Neolithic, Chalcolithic and Historic periods were brought to light.

Sankalia supervised doctoral dissertations of 47 students. The topics chosen by them covered a wide range in Ancient Indian History, Culture and Archaeology. Twenty-five of these were purely archaeological while two were ethnoarchaeological, and the remaining 20 related to Ancient Indian History, Culture and Archaeology. Dissertations based on field work, and pertaining to location of new sites, ethnographic data, and interpretation of old data. The remaining ten dissertations were concerned with topics based on library research like:- 1. Cultural History from the Vayu Purana, 2. The Cult of Vithoba, 3. History of Jaina Monachism, 4. Iconographical Elements in the Mahabharata, 5. Geometrical Approach to Prehistoric and Ancient Indian Pottery; 6. A Study of Harappan Pottery, 7.

Contribution of Upasani Baba to the Cultural Life of Maharashtra and India, 8. Archaeology and the Mahabharata, and 9. Scientific Approach to Astrology with Reference to Planets and Professions.

In addition to his personal research, Sankalia inspired a large number of young researchers at the Deccan College as well as other institutions in the country to pursue research in Prehistory. He supervised doctoral dissertations of 47 students. The topics chosen by them covered a wide range in Ancient Indian History, Culture and Archaeology. Twenty-five of these were purely archaeological while two were ethnoarchaeological.

Dissertations based on field work, and pertaining to location of new sites, ethnographic data, and interpretation of old data comprised the following:

Of these a brief account of those who undertook research on topics related to Mesolithic is given below.

A. Subbarao

Subbarao did his M.A. in Ancient Indian History, Culture and Archaeology from Lucknow University, and came to Pune to do a Ph.D. under the guidance of Prof. H.D. Sankalia. On the latter's advice, he decided to work on the Neolithic Culture of Bellary in Karnataka. Robert Bruce Foote, known as the Father of Indian Prehistory, had already discovered ground stone tools of trap and flaked tools of trap and chert at Bellary. As Sankalia was familiar with Foote's work, and also as Subbarao hailed from neighouring Andhra Pradesh, he advised the latter to work on the Neolithic Culture of Bellary. Apart from carrying out explorations on and around the Sannarsamma Hill, Subbarao conducted an excavation in the habitation deposit on the hill, and discovered not only ground and flaked stone tools but also hand-made, ill-fired, and grey-coloured pottery, typical of the Neolithic. His Ph.D. Dissertation, entitled *Neolithic Culture of Bellary*, was published as a monograph by the Deccan College in 1949.

Soon after getting his Ph.D. degree, Subbarao, on the recommendation of his *guru*, H.D. Sankalia, who was held in high esteem by Hansaben Mehta, Vice-Chancellor of the M.S. University of Baroda, as well as by her husband, Dr. Jivraj Mehta, Chief Minister of Bombay State, got a job as a Lecturer in the newly established Archaeology Department at the M.S. University of Baroda. As his first research project, Subbarao undertook an exploration of the Mahi river which flows immediately north of Baroda. In the sandy deposit along the banks of the river he discovered microliths, similar to those found by Bruce Foote in the same area some six decades earlier, and by Sankalia, in excavations at Akhaj and Valasana in the Sabarmati valley, and at Langhnaj in the Mahi valley.

Subbarao's exploration led to the discovery of a large number of Mesolithic sites in the Mahi Valley. One of them, Amarapur, was excavated by him on a small scale in 1951. The excavation yielded a geometric microlithic industry, made on quartz and chert, and pieces of hand-made, ill-fired pottery similar to those found at Langhnaj. Subbarao's comprehensive report, published in the inaugural issue of the *Journal of the M.S. University of Baroda*, in 1952, became a model for younger researchers. Subsequently, Subbarao excavated a sand dune Mesolithic site adjacent to the well-known Buddhist stupa at Devni Mori, in Banaskantha district, and found an industry made on quartz but typologically similar to that of Amarapur.

N. Isaac

Isaac began his career as a Lecturer in History at a Christian College at Kurnool in Andhra Pradesh and later became its Principal. While studying for his M.A. he had developed interest in Archaeology and learnt to identify stone tools with guidance of his teachers and help of publications on prehistory. He made sizeable collections of stone tools from the beds and deposits of seasonal streams originating in the Eastern Ghats and flowing eastward to join one of the major rivers. He classified the collections typologically under Sankalia's guidance and presented them in a bulky thesis which was of much help to students who followed him.

G.C. Mohapatra

Mohapatra hailed from Orissa, and, like Subbarao, had done his M.A. from Lucknow University. He did his Ph.D. on the Prehistory of Orissa and discovered a number of surface microlithic sites in north and central Orissa, and wrote their descriptive account. The core of his thesis was, however, devoted to Palaeolithic finds from the Mahanadi, Brahmani and Vaitarni river valleys. During his later career, Mohapatra confined himself entirely to work on the prehistory of the Siwalik region in Punjab and Himachal Pradesh. He discovered a number of

Sohanian and Acheulian sites, mostly on the surface of Siwalik terraces and on the banks of bordering streams, and argued, against the prevailing view that the Acheulian in the Siwalik region was older than the Sohanian.

V.N. Misra

Among Sankalia's students, V.N.Misra has been most active in Mesolithic research. Like Subbarao and Mohapatra, he too had done his M.A. from Lucknow University, but in Anthropology, unlike the former who had done so in Ancient Indian History. Immediately after passing his M.A. examination in July 1957, Misra was appointed as a Lecturer in Anthopology. A few months later, his teacher, the eminent anthropologist, D.N. Majumdar, advised him to go to Pune and do a Ph. D. in Prehistoric Archaeology as the Department needed a qualified teacher in Prehitory, which is one of the three main branches of Anthropology. Accordingly, Misra came to Pune in June 1958 and took admission in Poona University's Ph.D. course in Archaeology under the guidance of the eminent archaeologist, H.D. Sankalia of the Deccan College Post-Graduate and Research Institute. He began his field work in Rajasthan in 1958, and, with some interruptions for field work in M.P. and for other assignments, continued it till 2000 when he retired as Director of the Institute. During this period, he discovered or explored nearly 60 Mesolithic sites in Rajasthan.

These sites are located on both sides of the Aravalli Mountains, which divide Rajasthan into two unequal parts, the larger one lying on the western side. The eastern side receives more rain, has a large network of perennial and seasonal streams, is greener and more fertile. The western part is largely a sandy plain, receives much less rain, and has only seasonally flowing streams. Most of the land lying in Ganganagar, Hanumangarh, Bikaner, Jaisalmer, Barmer, Jalor, Jodhpur, Nagaur, Churu and Jhunjunu districts, comprising Marwar and Thal regions, is covered by sand sheets and dunes, and is either semi-arid or arid. Microlithic sites in this region are mostly located on sand dunes. In contrast, in the Mewar region, comprising the districts of Bhilwara, Chittaurgarh, Udaipur, Dungarpur and Banswara, the sites are located either on rocky surfaces covered by disintegrated rock or on sandy dune surfaces along river banks.

Important evidence of Mesolithic culture in Rajasthan comes from the two sites of Tilwara in Barmer Dist. and Bagor in Bhilwara Dist. excavated by Misra, Tilwara in 1967 (Misra 1971a, 1971b), and Bagor during 1968-1970 (Misra 1970a, 1970b, 1971a, 1971b, 1972, 1973a, 1973b, 1976a, 1976b; Misra and Nagar 1981; Lukacs *et al.* 1982).

Excavations at Bagor and Tilwara have provided excellent evidence of the simultaneous prevalence of technologically, economically and socially different modes of life which are so characteristic of India today, and were equally, if not more, true in the past. While a fully settled way of life based on plant agriculture and animal domestication, and characterized by occupational specialization, economic and social differentiation, impressive architecture, and other traits, had developed in Mewar at nearly a hundred sites as early as the fourth millennium B.C., at many sites like Bagor, people continued to live by hunting and animal husbandry. There is no evidence of farming-based settled life so early around Tilwara, located on the eastern fringe of the Thar Desert. In fact, such life does not seem to have appeared in the desert until the first millennium A.D. These societies, with highly contrasting modes of life, were not living in isolation but were interacting with each other and had a symbiotic relationship. The hunter-herders at Bagor obtained advanced materials like metal tools, pottery, and stone and bone beads from their Chalcolithic farming neighbours. The hunter-gatherers at Tilwara living at the eastern edge thar desert had no Chalcolithic farmers in their neighbouhood to obtain such materials and had to wait till the appearance of iron-using communities to obtain them. It is this interaction and symbiotic relationship between communities living at different chnological, economic, and social stages which has shaped the Indian society as we know it today.

Malti Nagar

Malti Nagar did her Ph.D. on the Ethnoarchaeology of the Ahar Culture of southeast Rajasthan, and studied ceramic industry, terracotta and metal objects, architecture, economy, food practices, and ornaments of the culture found at Ahar and Gilund and at sites explored by her and V.N.Misra at several sites in Mewar. She also made an ethnographic study of ceramics, bell-metal ornaments, ceramics and their manufacture, black-and-white painted designs on

Table 1: Ph.D. Dissertations in Archaeology Completed Under the Guidance of Prof. H.D. Sankalia

Name of Student	Year of Award of Degree	Topic of Research and Region
B. Subbarao	1949	Prehistoric and Early Historic Bellary, Karnataka
R.V, Joshi	1953	Pleistocene Studies in the Malaprabha Basin, Karnataka
K.D. Banerjee	1957	Middle Palaeolithic Industries of Maharashtra
A.P. Khatri	1958	Stone Age Cultures of Malwa, (M.P.)
N. Isaac	1960	Stone Age Cultures of Kurnool, Andhra Pradesh
G.C. Mohapatra	1960	Stone Age Cultures of Orissa
Z.D. Ansari	1960	Geometrical Approaches to Pehistoric and Ancient Pottery
V.N. Misra	1961	Stone Age Cultres of Rajputana
P.R. Sharma	1963	Archaeology of Nepal
M.K. Dhavalikar	1963	Life in the Deccan as Depicted in the Ajanta Paintings
R. Singh	1965	Palaeolithic Indusries of the Northern Bundelkhand (M.P.)
Malti Nagar	1966	The Ahar Culture: An Archaeological and Ethnogaphic Study
S.N. Rao	1966	Stone Age Cultures of Nalgonda District, Andhra Pradesh
M.L.K. Murty	1966	Stone Age Cultures of Chittoor District, Andhra Pradesh
M.S. Nagaraja Rao	1966	Chalcolithic Cultures of the Deccan (North Karnataka)
Nisar Ahmed	1966	Stone Age Cultures of the Upper Son Valley
R.S. Pappu	1966	Pleistocene Studies in the Upper Krishna Basin
K. Paddayya	1968	Pre- and Proto-historic Investigations in Shorapur Doab
S.G. Supekar	1968	Pleistocene Stratigraphy and Prehistoric Archaeology of the Central Narmada Basin
K. Thimma Reddy	1968	Prehistory of Cuddapah (Andhra Pradesh)
A. Sundara	1969	Megaliths in North Karnataka
Omi Manchanda	1969	A Study of Harappan Pottery
P.B. Gadre	1969	Cultural Archaeology of Ahmednagar During the Nizam Shahi
R.D. Choudhary	1969	Archaeology of the Brahmaputra Valley of Assam (the Pre-Ahom Period)
Rahman Ali	1970	Art and Architecture of the Kalachuris of Tripuri
Suman Pandya	1973	An Ethnoarchaeological Study of the Harappan and Post-Harappan Cultures of Saurashtra
V.S. Wakankar	1973	Painted Rock Shelters of India
Statira Guzder	1975	Quaternary Environments and Stone Age Cultures of the Konkan, Coastal Maharashtra
S. Chakrabarti	1978	The Prehistory of Bhavanagar Ditrict, Saurashtra, Gujarat State
J. Armand	1980	Excavations at Durkadi: A Pre-Acheulian Occupational Site on the Ancient Banks of the Narmada, W. Nimad District, Central India
S.A. Sali	1981	Stone Age Cultures of Patne, District Jalgaon, Maharashtra

women's *odhnis* (head and upper body covering sheets), architecture, dress and ornaments, food habits, and religious beliefs and practices of the rural and tribal communities and noted common features between Chalcolithic and living cultures. She was particularly impressed by the similarity, between Chalcolthic bell metal ornaments and those made by present-day craftsmen and used by tribal and peasant women today, Chalcolithic and rural architecture, and most patrticulaly the painted designs on Chalcolithic Black-and Red Ware vessels and the *odhnis* (printed sheets) used by rural women for covering their head and upper part of the body.

Nagar collaborated with me in preparing a comprehensive typology of Mesolithic tools (Misra and Nagar 2010) and in classifying large collections of Mesolithic artefacts from Bagor and Tilwara (Misra and Nagar 1981).

S.N. Rao

Rao did his. Ph. D. on the Stone Age cultures of Nalgonda District, Andhra Pradesh in 1966. His thesis mainly consisted of a study of Palaeolithic finds but he also discovered a few microlithic sites and briefly described them. Later on, he excavated the Neolithic site of Sarutaru in Meghalaya and Assam, and noted close parallels in the forms and functions of Neolithic ground tools and those used in *jhum* or shifting cultivation today. Similar observations had earlier been made by T.C. Sharma in his studies of Hoabinian and Neolithic tools and those used in agriculture, basket-making and other crafts.

M.L.K. Murty

Murty obtained his M.A. in Archaeology from M.S, University Baroda, and was deeply impressed by his teacher, B. Subbarao's ecological approach to interpretation of historical and archaeological data, and successfully used it in his interpretation of the integration of tribal (Chenchu, Kuruba and Yenadi elements) in Hindu culture, particularly in the rituals of the Shiva temple at Srisailam.

Murty studied the Palaeolithic and Mesolithic cultures of the Renigunta region of Chittoor District. He discovered Lower and Middle Palaeolithic industries on rocky surfaces in the Renigunta valley and Upper Palaeolithic assemblages in the sandy deposit along the banks of the Suvarnarekha river. All the assemblages were made of quartzite but those of the Upper Palaeolithic were made of more fine-grained quartzite. The assemblages comprise long, parallel-sided blades, thick crescents similar to elouera crescentic tools of Australia, points, burins of several types, and side and end scrapers. These are the most typical Upper Palaeolithic industries found in India.

Overlying the Upper Paleolithic assemblages and occurring in the same sandy deposit were microlithic industries made of more fine-grained quartzite as well as chert. Typologically, they comprise backed blades, crescents, triangles, trapezes, side, end and round scrapers, and burins of a variety of types. Perforated circular stones or ring stones are a characteristic feature of these Mesolithic industries. Murty believes that they were used as net sinkers by Mesolithic fishermen like the Yenadi fishermen of today. Yenadis are a tall and slim people living by hunting-gathering and fishing along the Suvarnarekha river. They catch fish by using long nets. With their oiled shiny bodies, fishing in deep pools of the river, the Yenadies look like having come straight out of the prehistoric period. Both Yenadis and Chenchus, the latter studied by Murty after he had completed his Ph.D., are closely related to non-tribal communities. The Chenchus have been patially integrated into the Hindu Society and perform various chores in the Shiva temple at Srisailam in the Eastern Ghats. According to tradition, a pretty Chenchu maiden was married to Vishnu who had taken the form of a Chenchu, and she came to be known as Chenchulakshmi.

K. Paddayya

K. Paddayya did his M. A. from the Department of History, Andhra University, Waltair, and was advised by his professor to go to Pune and do his Ph.D. in Archaeology under the guidance of Prof. H.D. Sankalia at the Deccan College. He chose to work in Shorapur doab in Bijapur District of Karnataka, and concentrated on the Hunsgi and Baichbal valleys of the Bhima basin. The valleys are surrounded by limestone and quartzite hills which provide excellent fine-grained raw material for the manufacture of tools. In an intensive survey spread out over a period of nearly two years Paddayya located a large number of sites in primary and semi-primary contexts buried under thin alluvial depoits. Many of these tool-bearing localities have been exposed by ploughing action. The artefacts found at them belong to different developmental stages but can be broadly grouped into Early and Late Acheulian. The major localites investigated comprise Hungi, Yediapur and Isampur.

Detailed geoarchaeological studies and investigations carried out by Paddayya at Isampur in the Hunsgi valley exposed a quarry-cum-occupation spot, covering an occupation spot covering an area of 0.75 ha. It is associated with a weathered rock outcrop consisting of silicified limestone blocks of suitable sizes and shapes. It preserved a 20-30 cm thick *in situ* Acheulian level just below 50 cm thick brown silt deposit. Trench I exposed seven chipping clusters (each 6-8 m. square in extent) made up of cores, flake blanks, cores, finished tools, hammerstones and debitage, all found in mint condition. The total assemblage from this trench comprised over 15,000 artefacts, illustrating the manufacturing trajectories adopted by the hominids to produce various categories of implements. Small amounts of fossilized dental and bone remains of bovids and cervids, and turtle shell pieces were also found with cultural material. Three electron spin resonance dates obtained on fossil tooth enamel of animals belonging to *Bos species* found in the excavation gave an average value of 1.2 Myr, thereby making Isampur the earlist known well-documented Palaeolithic site in South Asia.

Besides his work on the Lower Palaeolitic, Paddayya carried out significant work on the Neolithic Culture of Karnataka, particularly excavations at the ashmounds of Kodekal and Budihal. Budihal is a large site comprising a habitation area, an ashmound and an animal butchering area. The site is being rapidly destroyed by digging of the ash by farmers for use as manure in their fields. A large number of C-14 were obtained by Paddayya from ashmound, habitation and animal butchering floor area

Paddayya has devoted his career mainly to the study of the Lower Palaeolithic and Neolithic cultures of Karnataka. His notable contributions are excavation of a number of Acheulian localities, particularly Hunsgi, Yediapur and Isampur, and the Neolithic habitation-cum-ashmound site of Budihal near Hunsgi in Gulbarga District. He has earned international fame for work in these fields as also in Theoretical Archaeology. His work on Mesolithic is peripheral and confined to the discovery and study of Hunsiholi assemblage of the Hunsgi area (Paddayya 1967).

09. K. Thimma Reddy

Thimma Reddy did his Ph.D. in 1968 on the prehistory of Cuddapah District of Andhra Pradesh. Like all Ph.D.s of that time, his was also based on the exploration of stone age sites in river bank deposits and presenting a descriptive account of the localities, their stratigraphy, and typology of assemblages. His notable work is on the Vemula Upper Palaeolithic Industry. He also collaborated with M.L.K. Murty in the excavation of Upper Palaeolithic localities in Kurnool limestone caves. Reddy's work on the Mesolithic is restricted to the discovery and descriptive account of a few surface assemblages.

Suman Pandya

Suman Pandya studied ancient history at Gujarat Vidyapeeth in Ahmedabad, and did her Ph.D. in 1973 on An Ethnoarchaeological Study of Harappan and Post-Harappan Cultures of Saurashtra. She published a few papers and regularly presented her work at ISPQS conferences. Suman became a lecturer in, and later principal, of a college in north Gujarat. In her later career she discovered a sand dune microlithic site at Dhansura in Sabarkantha District of Gujarat. On her request, V.N.Misra helped her in carrying out a preliminary dig at the site in 1988. The dig yielded a quartz and chert microlithic industry typical of north Gujarat sand dunes, and also human skeletons which were almost certainly later interments. Results of the dig were published in *Man and Environment,* XIV (1) in 1989.

V.S. Wakankar

V.S. Wakankar was an artist, his forte being painting. He worked among the aborigines of Malwa, travelling to their settlements and helping them by teaching them to read and write. During his travels in the hilly and forested landscape he came across rock paintings, and being a painter, was fascinated by them. He started copying them in free hand in pencil and black ink. He met Sankalia in 1952 when the latter was excavating the Early Historic site of Maheshwar on the Narmada, and showed him his copies of rock paintings. Sankalia was highly impressed by the paintings and advised Wakankar to work on them for a Ph.D. degree. Though he took nearly two decades to complete it, Wakankar's well-illustrated thesis, entitled *Painted Rock Shelters of India*, is the first systematic and comprehensive study of rock art in India. It inspired a number of other researchers like Yashodhar Mathpal, Shyam Kumar Pandey, Giriraj Kumar and N. Chandramouli to pursue study of rock art. The rock paintings copied by Wakankar from shelter walls, ceilings and hollows in the rocks throw a flood of light on the life of Mesolithic hunter-gatherers.

S.A. Sali

Sali was an Assistant Superintendent in the ASI and an active researcher. He had worked with M.N. Deshpande, DG, ASI, and had received much encouragement from him. Sali assisted him in the excavation of the Chalcolithic site of Daimabad, and was responsible for writing the excavation report and getting it published from the ASI.

Sali's contribution to our knowledge of the Mesolithic consists of his excavation of the alluvial site of Patne in Jalgaon District of Maharashtra. Here he encountered a long evolutionary sequence of Upper Palaeolithic and Mesolithic artefact assemblages. In addition to stone artefacts, the Upper Palaeolithic horizon yielded a sub-rectangular piece of ostrich egg shell with sharply incised cross-hatched design on it and a couple of perforated circular beads of the same material. The Upper Palaeolithic horizon is C-14 dated to c. 25,000 years B.P.

The Mesolithic deposit overlying the Upper Palaeolithic one without a break shows several technological stages in the evolution of the microlithic industry from non-geometric to geometric stage and is made entirely of chalcedony. No other site in the country has provided such clear evidence of technologicalcal evolution from Upper Palaeolithic to Mesolithic stage.

There are over 50 radiocarbon and TL dates for the Mesolithic culture from many sites. The earliest date of c. 35,000 years B.P. comes from Mehtakheri on the Narmada in M.P., excavated by Sheila Mishra. (personal communication). This and a few other as yet unpublished dates establish that the antiquity of the Mesolithic period in India matches that of this period in Sri Lanka and Upper Palaeolithic in Europe. It also shows that prehistoric South Asians were no less innovative than their African and European counterparts.

Conclusion

Sankalia's career is a brilliant essay in untiring hard work, despite a frail physique, dogged perseverance, and uncommon good luck. His example inspired at least three generations of students not only of the Deccan College but of many other institutions in South Asia. I was supremely lucky to have had this extraordinary scholar as my mentor. This lecture gives me an opportunity to offer my humble tribute to him.

As in the case of Chalcolithic and Ethnoarchaeology, Sankalia was a pioneer of Mesolithic studies. To him goes the credit of not only excavating the first Mesolithic site in India, namely Langhnaj, but also of enlisting the cooperation of several Indian and foreign scholars for studying the environment and faunal and human skeletal remains. Sankalia published a number of articles on Langhnaj in Indian and foreign journals. He was also instrumental for publication of three monographs on this excavation. Besides, he trained a number of students who did research on the Mesolithic. Among them the contribution of V.N. Misra is most notable.

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Tewari Rakesh, *Man and Environment* XXXVI(1): 14-30 [2011].
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'.... Given another life ....'*

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It was a pleasant surprise to hear from office bearers of the Society during the Allahabad Conference (Nov. 2009) who gave me the opportunity to deliver the Presidential Address of 2010. I feel honoured to be here in this capacity. I also realize that as the closure of my field work is nearing, I have grown old enough to deliver this address, and, this is the time to pause and ponder on the work done by us during over the past three decades. A considered review in this regard makes amply clear that during this lifetime we have been able to obtain only a feel of certain aspects of Indian archaeology. There are many more questions to be addressed. To accomplish that, many more lives are required. Therefore, in this presentation I would like to underline what I could do in archaeology, if I were given a chance to live again. Our young colleagues and the upcoming generation, who have plenty of time in hand, may find at least a few of these issues worthy of their attention.

At this juncture, I am emotional as I learnt my first lessons in Ancient Indian History in the same department in the University of Lucknow where I am stand now, after completing around 40 years. Bitter-sweet memories of those dreamy days are still fresh in my mind. Some of my teachers, particularly Prof. K.K. Thaplyal, are gracing this august gathering. I extend my humble regards to them. Fortunately two of my class-fellows, Prof. Amar Singh and Dr. S.N. Upadhyay are also present here to encourage me as they did during my student days. With all the best wishes to them and all of you, now I come to issues to attract your attention.

This paper aims to underline certain issues in Indian archaeology with the objective to share them with the colleagues and particularly with the younger generation who might find them useful for their future work. We are fully aware that they are not inclusive of all such issues and also that the learned scholars (e.g. Tripathi 2008; Chakrabarti 1988a, 1999: 319-338; 2001: 1-33) have already pointed out at many such issues, and experienced field workers shall certainly add more.

Palaeolithic Period

To understand human behaviour in a particular period a clear understanding of the occupation of sites with respect to their geo-climatic conditions and chronological context is a pre-requisite. Though hundreds and thousands of Palaeolithic remains have been reported from different areas of India most of them are either surface finds or from secondary deposits. Some dated sequences known from Riwat (*c.* 2.00 Ma), Pabbi Hills (2.2 to 0.9 Ma) and Potwar region (0.4 to 0.7 Ma) (Pakistan), Uttarbaini and some other sites (c. 2.00 Ma onwards) (upper Siwaliks, India), Isampur (1.27 ± 0.17 Ma) (Karnataka), Amarpura formation (~0.8 Ma) (Rajasthan), Bori (~1.4 to 0.67 Ma) (Maharashtra) (see Gaillard *et al.* 2010; Paddayya 2008; Pappu *et al.* 2011), and Kalpi (*c.* 45 000 B.P.) (Singh *et al.* 1999; Singh, I.B. 2001, 2002, 2004a, 2004b; Tewari *et al.* 2002) and Belan (72 - 85 kyr BP onwards) (Gibling *et al.* 2008) in south Uttar Pradesh are the exceptions in this regard. The reliability of many of these ages has been questioned (Chauhan 2010). Recent dates have been determined with more precision and wider implications regarding the Acheulean site at Atirampakkam (average age 1.51 ± 0.07 Ma) in south India (Pappu *et al.* 2011; Dennell 2011). We need more and more such investigations in South Asia. A few *in situ* sites such as Paisra (Pant and Jayaswal 1991), Bhimbetka (Misra 1989: 69-73) and Isampur (Paddayya 2008) have also been subjected to excavations and studied in detail. Human remains are available from Hathnora (Paddayya 2008) in Madhya Pradesh. Some geo-climatic profiles have also been worked out for Kashmir, Rajasthan, Gujarat and Son Valley. However, specific environmental profiles and dated sequences in specific geo-climatic zones in all the remaining areas are wanting. Therefore,

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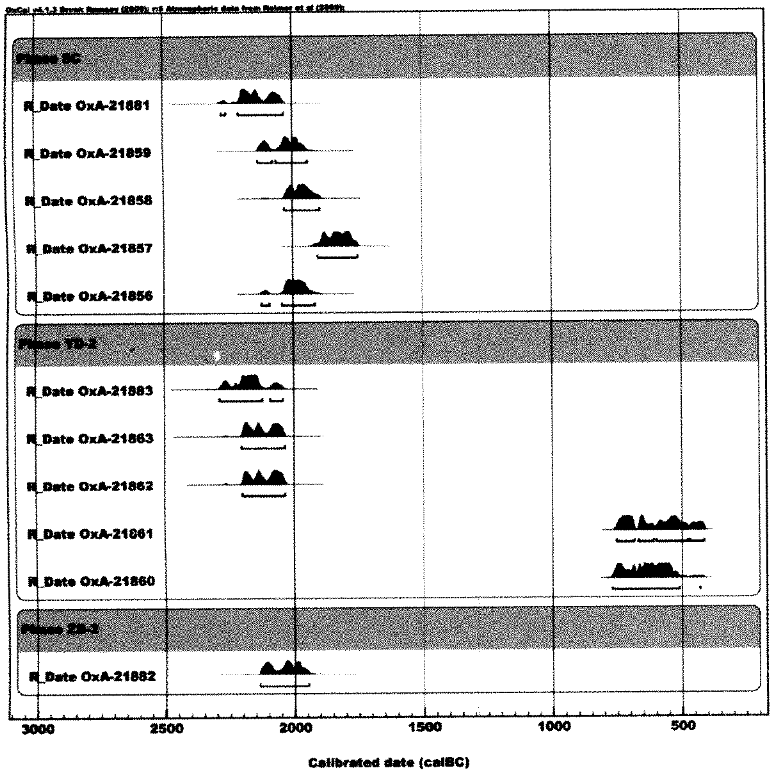
* Presidential Address delivered at the XXXVIII Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, Lucknow University Lucknow, 28 December 2010.



the trend of detailed area exploration and settlement-subsistence study, initiated in 7th decade in order to locate more and more *in situ* Palaeolithic sites, study of geo-formations integrated with fossil fauna and environmental profiles, controlled with scientific dating is highly required. Apart from that, as pointed out by Paddayya (2008) the study of ethnographical parallels would certainly add very important aspects to the Indian Palaeolithic studies.

Rock art

Since the discovery of painted rock shelters in Sohagi hills (district Mirzapur) in late 19th century by A.C.L. Carlleyele hundreds of such shelters have been reported from different hilly regions in India. Rock paintings depicted in these shelters have been described in terms of their subject matter, superimposition and state of preservation. Some attempts have been made to interpret their meaning and purpose. Myths are narrated through some of the compositions such as 'Lorikayana episode' depicted in Kauakhoh rock shelter (district Sonbhadra) (Tewari 1990). Some paintings of the historical period are clearly associated with religious rituals and activities. A chronology has been suggested mainly on the basis of comparative considerations, relative superimpositions and subject matter. On the basis of radiocarbon dates available for cultural deposits comprising rubbed haematite pieces exposed during the archaeological excavations in some of the painted rock shelters, earliest rock paintings have been placed around 6th millennium B.C. In Europe and other continents, some stone blocks bearing paintings, broken off from the ceiling of the rock shelters and caves have been found embedded in the datable cultural deposits of their floors. Direct dating methods have also been applied. In India, despite a few attempts satisfactory results are still awaited in this regard. Excavations in more rock shelters and application of latest methods are required to address this problem. Evaluation of Indian rock paintings as art compositions, ethnological studies to understand their meaning and purpose, and scientific studies to understand the composition of colouring material are the other aspects to be studied with more focus. In comparison to natural vagaries human threats are posing more danger to the existence of these paintings across the country. It is a great challenge to formulate effective measures for their protection, conservation and preservation. Some initiatives have been taken up in this direction regarding some of the important painted rock shelters by the respective governments. However, declaration of certain areas comprising the concentration of painted rock shelters as heritage corridors and national heritage parks on the similar models adopted in Australia and Europe according to their applicability may also be considered.

Food production/ sedentary settlements

The beginnings of food production involving the domestication of plants and animals by man is regarded as the most important phenomenon for a sedentary life, which further paved the way from rural to urban growth. This process is believed to have begun with the exploitation of natural resources in the Palaeolithic period. The most prevailing view in this regard is that fluctuating environmental conditions during the Terminal Pleistocene and Early Holocene periods provided favourable conditions for this. The area extending from Israel to Turkey and to north Iraq has been marked as Fertile Crescent for the origins of the cultivation of wheat and barley and domestication of sheep and goat. Another Fertile Crescent has emerged in East Asia distinguished for the beginning of rice and millet cultivation. South Asia, placed almost in between, is commonly regarded as an area that received the 'backwaters' from both directions. This implies that cultivation of wheat and barley arrived here from West Asia, and migrants from China/Southeast Asia carried the practice of rice cultivation from the east. However, investigations carried out in recent decades point to a different pattern.

Consistent excavations at Mehrgarh in Baluchistan (Pakistan) have provided evidence for an independent centre of domestication of zebu (Indian cattle) and barley around the 8th-7th millennium B.C. Excavations at Koldihwa, Jhusi, Heta Patti and Lahuradewa mark the Middle Ganga Valley as a potential area for the evolution of rice cultivation and domestication. Kashmir Neolithic sites form a separate zone in this respect. The excavations at Ahar culture sites represented by Balathal and Gilund in south Rajasthan, Karnataka, Orissa and north-eastern areas may also be other potential regions where this process would have begun independently.

Palaeoenvironment

Palaeoenvironmental profiles suggested for Baluchistan (Costantini 2008; Constantini and Lantini 2000), Kashmir (Agrawal 1992), Ladakh (Bhattacharya 1989), Rajasthan (Singh, G. *et al.* 1990), Central Ganga Plain (Gupta 1976; Pant and Pant 1980; Sharma *et al.* 2004; Chauhan *et al.* 2004), North Vindhya (Pant and Pant 1980), Western Ganga Plain (Kumar *et al.* 1996), and Lahuradewa, Middle Ganga Plain (Uttar Pradesh) (Chauhan *et al.* 2005), Nilgiri (Kerala) (Chakrabarti 2006: 106) and Horton Plains (Sri Lanka) (Premathilake 2008) have provided very significant data in this regard. However, considering the extent and varied geo-climatic zones of South Asia present status does not match with our requirements. Therefore, identification and excavation at more potential sites and high-resolution palaeo-climatic studies in all the geo-units across the India, in scientifically dated contexts, for at least the Holocene period are prime priorities. Studies related to plant and animal DNA should be initiated to keep pace with modern trends of scientific studies.

In the area where we have worked, i.e. Middle Ganga Plain, archaeological excavations at previously excavated sites such as Koldihwa, Kunjhun, Jhusi, Hetapatti, Sohgaura, Imlidih Khurd, Chirand, Panr, and Taradih may be very rewarding in terms of strengthening earlier evidence and to understand related aspects in further detail. Floatation of the carbonised floral remains and high resolution conventional and AMS radiocarbon dates for the carbonised grains and stratified cultural material should be the main objectives to build up a more convincing chronology and cultural history. The presence of barley and wheat at Jhusi in the horizons dated to the 7th-6th millennium B.C. requires a specific focus. Since such an early occurrence of these grains in this part of the country is the first incidence of its kind with wider implications it needs further confirmation by AMS dating of the grains and more evidence from other sites.

Symbiotic relations between Hunter-gatherers and Food Producers

The studies carried out on the human skeletal remains (Kennedy 1996, 1999; Kennedy *et al.* 1986, 2002; Lukacs 1992, 2002; Lukacs and Pal 1992, 1993, 2003; Lukacs *et al.* 1996; Vallianatos 1999; Robbins *et al.* 2003) recovered from excavations from the Mesolithic Sites of district Pratapgarh have provided a corpus of primary information to understand different aspects of hunter-gatherers inhabiting the Ganga Plain. One of these aspects relevant in the present context is as follows: 'The dental pathology profile includes features typically associated with a hunting-gathering or foraging adaptation. One exception is the high prevalence of linear enamel hypoplasia, which generally attains high rates upon the adaptation of agriculture.' Lukacs and Pal (1993: 757) have noted in this regard that: "The dental pattern of these Mesolithic North Indian populations is more similar in degree of wear and prevalence of most dental afflictions to that of hunter-gatherers than to that of agriculturists". One clear exception to this generalization, the high prevalence of linear enamel hypoplasia, requires explanation, although it seems to agree with recent reports of high linear enamel hypoplasia among Mesolithic peoples of Europe (Meiklejohn and Zvelebil 1991). No other features of the wear or pathology of the dentition of specimens from DDM, MDH, or SNR would suggest incipient development of agriculture or its correlate, sedentism." Misra (2002: 23) has also underlined that "Dental enamel hypoplasia is frequently encountered in food producing sedentary populations, ancient and modern, so its relatively high incidence in individuals from these Mesolithic Gangetic sites is unusual." The occurrence of dental enamel hypoplasia is as high as 93.8 % at Damdama and 63.6% at Mahadaha (Lukacs and Pal 1993: 754).

Mesolithic remains at these sites have been dated to between c. 6000-2000 B.C. Notably, early food producing communities also inhabited the Ganga Plain during this period. Their remains have been recovered at Jhusi and Hetapatti in the neighbouring Allahabad district and at other sites of the Middle Ganga Plain. These people were growing rice, barley and wheat, etc. It seems that these communities had some interaction with each other, over a long duration which gradually contributed in developing a symbiotic relationship between them. The recovery of domesticated cereals of rice and barley at Damdama (Tewari *et al.* 2003: 54; Saraswat 2004b: 47) (datable on the basis of two AMS ^{14}C determinations, i.e. c. 2578 and 2110 B.C.) strongly indicates that these agriculturally produced crops would have been procured from the contemporary early farmers and their consistent use seems to be the root cause for *the high prevalence of linear enamel hypoplasia* amongst the hunter-gatherers of Damdama and Mahadaha as well. The occurrence of corded ware at some of the Vindhyan Mesolithic sites, the use of microliths at Jhusi in early historic context and presence of NBPW and earlier pottery in the microlithic cultural assemblage at Semar-Sadhopur excavated in collaboration of BHU and U.P. State Archaeology Department) shows continuity of this relationship. Keeping this phenomenon in view we should try to understand the existence of respective cultures side by side having symbiotic relationships from the very beginning to the modern times instead of looking into the models of unilinear development of cultures.

Evolution of the First Urbanisation

The present perception on the evolution of the first urbanisation (Harappan Civilization) in South Asia largely revolves around preceding cultures of its north-western region. Questions about the possible role of contemporary cultures in its eastern, northern or southern surroundings are hardly considered which might have contributed significant components in its growth. The areas around north and south Rajasthan, Kashmir and the Aravallis should also be looked at in this respect. Another important issue regarding this civilization is its relations with contemporary cultures of these areas. It is believed that this civilization flourished in the north-western and western part of the South Asia and interacted with western Asia, however, they had either marginal or altogether no cultural contacts with the other areas of South Asia, and after the decay of first urban centres around 2000 B.C. the inhabitants of this area migrated and colonized most of these areas. However, recent studies indicate contacts with these areas right from the 3rd millennium B.C. The presence of domestic goat, circular steatite beads, copper arrowheads, etc. at Lahuradewa, bronze objects at Daimabad (Maharashtra) and appearance of rice and corded ceramics in the Harappan context are to be noted in this regard. This aspect requires a more focussed attention.

The most debated issue related to this civilisation is its relation with the chronology and existence of the Saraswati river. Many amateurs, as well as scholars from South Asia and abroad are deeply concerned with this problem. The study of the formation and dating of sand dunes and channels in western India is essential for understanding the evolution, survival and decay of the Harappan civilization and transformation of cultures in the subsequent period. The study of lake sediments, river-beds and pollen profiles, when integrated with the study of floral and faunal remains, may provide very important data in this regard.

Second urbanisation

Ancient Indian literature provides genealogies of the dynasties of Ayodhya, Pratisthanpur (Jhusi), Varanasi, Kausambi, etc. which comprise a long list of kings ruling in the pre-Buddha period. On this basis a group of scholars has been in favour of early political activities and existence of certain political centres/towns in this region from about 3000 B.C. On the other hand most archaeologists and historians believe that these cities evolved between 800-600 B.C. on the basis that evidence revealed in archaeological excavations at these places does not go beyond *c.* 800 B.C. Sharma's observation (1983: 106-7) is worth quoting in this regard:

"Of course the structures in the pre-300 B.C. phase found in eastern UP and Bihar are not impressive. But the reasons for the poor survivals of pre-burnt brick structures are ecological and, may be, we need more sophisticated archaeological skills and methods to recover them. But a society which used *de luxe* ware called NBP, and a good many iron objects for war and production could not do without houses, however modest they may have been. The absence of burnt brick structures therefore does not necessarily mean the absence of towns; on the contrary literary texts suggest their beginnings.

Some sanskrit scholars notice the presence of urbanism in the late Vedic period. They may well be right if that phase is placed in the middle of the first millennium B.C. but to take it back by a couple of centuries may not be supported by archaeology. Similarly we can not assign the beginning of urbanism to *c.* 300 B.C., on the basis of fire-baked brick structures. The conjunction of literary and archaeological material indicates the advent of towns in the middle Gangetic plains around the sixth century B.C. To begin with, people in towns lived in wooden houses. The use of wood at Pataliputra for this purpose is well attested."

Indeed Sharma's observations are very logical regarding the beginning of urbanism before pre-300 B.C.: the absence of burnt brick structure does not necessarily mean the absence of towns and to begin with people in towns lived in wooden houses. However, considering the presently available archaeological evidence, the surmise submitted by him on the basis of the use of NBP and iron artefacts on 'the advent of towns in the middle Ganga plains around the sixth century B.C.' needs to be reviewed.

Sharma's arguments submitted about the period between 600 B.C. and 300 B.C. may also be very well applied to the pre-NBP phase settlements of the middle Ganga Plain. The existence of *sodasa mahajanapadas* around the sixth century B.C. itself shows that their evolutionary stages must have covered a long span of time. At present, more than 270 excavated and explored ancient sites datable to pre-800 B.C. are known to us. Many of them are dated to 2nd and 3rd millennium B.C. on the basis of consistent radiocarbon dates. Some of these sites are as big as 500-750 m in length and about 200-250 m in breadth. The cultural assemblage of these sites shows mastery in the production of beautiful pottery and artefacts in that early period. The plain and painted thin sectioned black slipped ware with a very fine glowing texture may well be regarded as a *de luxe* pottery of the period between *c.* 2000 and 800-700 B.C. Skilfully made bone arrowheads and other objects, advanced agriculture and long distance contacts attested by cultural material such as stone beads and floral and faunal remains indicate a well organised society with political, social and trade mechanisms. Evidence emerging from some sites such as Lahuradewa, Imlidih, Sohgaura, Jhusi, Senuwar, Chirand and Taradih is pushing the antiquity for the beginning of these formations to the early third millennium B.C. Considering these aspects it has aptly been observed that: "the emergence of the second urbanization should not be looked as sudden outburst of economic activities side by side with new political awareness." (Misra and Gupta 2006: 30)

It would not be justified to declare that the pre-NBPW settlements belong to underdeveloped or backward rural communities only on the basis of the archaeological remains represented by post-holes and wattle-and-daub structures. Archaeology has its own limitations and one cannot ascertain on the basis of archaeological evidence how beautiful or elementary these structures might have been. Since bamboo and straw were available in more than sufficient quantities the same would have been the most preferred material for raising structures as may be seen in villages of this area even today. There was no need to opt for the painstaking process of making mud or burnt brick structures. Therefore models formulated to understand the process of evolution of cities, regarding the first urbanisation should not be strictly applied to the geo-climatically different region of the middle Ganga Plain. Early urban centres evolving in this part of the country would have had different features in comparison to those which developed in the western part of the country. To obtain a clear idea on the extent and settlement patterns of the pre-

NBPW settlements of this region, large scale area excavations at some selected sites and ethnographical studies are a must.

Study of old mining, smelting and metallurgy in a chronological order

Metallic objects begin to appear in south Asia from pre-3000 B.C. Some studies on metallurgy, resource areas, traditional knowledge and allied aspects have also been carried out (e.g. Agrawal 1971, 2000, 2003; Agrawal *et al.* 1990, 1991, 1992; Bharadwaj 1979; Hegde 1991; Biswas and Biswas 1996; Balasubramanyam 2008; Chakrabarti 1988b, 1992; Chakrabarti and Lahiri 1996; Neogi 1914; Tripathi 1998, 2008; Singh, R. N. 1989, 2007; Upadhyay 2007). However, detailed investigations in this direction in dated contexts are certainly lagging behind. We hardly have any clear idea about which mines were exploited in ancient times and what was the mechanism involved for laying shafts to procure raw material, as also how and where finished products were supplied and the economics involved. The areas comprising copper and iron smelting sites such as those related to the Ganeswar-Jodhpura culture in north Rajasthan, southern Megalithic culture and iron smelting sites of Malhar-Naugarh area of Uttar Pradesh may be considered to be focal areas in this respect. The Kolar and other gold mine areas also need exploration to understand their relation with ancient human activities in different periods. Chakrabarti (1999: 329) has already pointed out the necessity of investigation on this subject.

Upper Ganga Plain

Recent finds from the Upper Ganga Plain including a hoard of Harappan jewellery from Mandi (district Mujaffarnagar) (Tewari 2004) and from a cemetery from Sanauli (district Baghpat) (Sharma *et al.* 2006), which have given a new dimensions to the archaeology of this region and have raised new questions to be addressed. The hoard from Mandi is the largest so far found in India. Excavations carried out by the ASI to understand its context and other aspects could not reveal much. The suggested chronology of these finds is still based on comparative considerations. The cemetery site at Sanauli is the only known Harappan cemetery in the Upper Ganga-Yamuna Doab. It has provided clear evidence to associate antennae swords along with their sheaths (an important component of the Copper Hoard Culture) with skeletons recovered at this site. Most scholars place these finds around 2000 B.C. on comparative considerations. The settlement sites related to this cemetery may reveal more important evidence on the association and chronological context of the Copper Hoards on scientific grounds.

A series of AMS dates (Fig. 1) for Alamgirpur determined by the Oxford Radiocarbon Accelerator Unit has provided a dependable base of *c.* 2300 B.C. or a little earlier for the antiquity of this site (personal communication to the author by Dr. R. N. Singh; Dr. K.S. Saraswat). The long standing puzzle is as to whether this area was inhabited by humans during the Harappan and pre-Harappan period. Therefore, more excavations at some potential sites supported by scientific dates may provide a clearer understanding in this regard.

North Bihar, Lower Ganga Plain and Northeastern India

As mentioned above over 270 sites dating to pre-800 B.C. have been reported from the Middle Ganga Plain and surrounding areas. The number of such sites in north Bihar (Kosi-Mahananda Plain) is a few. Except the area comprising the eastern flanks of the Rajmahal hills similar status prevails in west Bengal. In Bangladesh the antiquity of known sites is still later. The most logical reason for the same seems to be the consistent devastating floods of the rivers Kosi, Tista, Ganga, Brahmaputra and their tributaries, which erode a large mass of land e every year and leaves no room for primary deposition. Therefore, we need specific strategies to identify remains related to early human activities in these geomorphological units. Pollen, phytolith, diatom and allied studies on the sediments procured by deep lake coring and AMS dating of the lower deposits (even if they are secondary) may provide significant results in this regard.

Northeast India comprising a hilly terrain of the Arakan ranges and bordering regions of Myanmar and South China, must have received cultural spill-overs from both directions. At the same time it would have been a focal area in dispersing external and indigenously evolved cultural traits across these regions. Cultural influences from Southeast Asia and South China are often suggested on the basis of the presence of certain ceramic industries comprising corded ware, tripod vessels, etc. and shouldered stone axes in this region. An enquiry into these issues and on prehistoric origins may be very rewarding and requires a well-planned research project involving large scale exploration in order to locate potential sites, in order to carry out extensive excavations supported by studies of faunal remains, palynological and geoarchaeological studies and to obtain dates. Particular focus in this regard may be on the Brahmaputra-Lohit-Bamo alignment in the north and along the Imphal route, in addition to terraces and lake

Interactions within South Asia

Interactions between contemporary cultures within South India may be another line of enquiry. The extent and means of resources used, e.g. minerals and stones etc. (used for manufacturing artefacts and ornaments) and subsistence practises, are the primary source for understanding the dynamics of early interactions. For example the study of sources of steatite and other stones found at Harappan sites have given very significant leads (Lahiri 1992; Law 2011). Recent observation by Randall Law (2011: 279) is worth noting in this regard. He states

"It is also quite possible that some agate from sources adjacent to the Gangetic Basin, such as those Mirzapur and Banda area of the Vindhyan Range (Chatterjee 1963a 168; Kumar 2005: 363; Srivastava *et al.* 1983), ended up at Indus Civilization sites in Haryana or the Punjab. I have recently examined (Law *in preparation*) the stone artefacts from the early levels of Lahuradewa, District Sant Kabir Nagar, Uttar Pradesh (Tewari *et al.* 2006). Those levels are filled with steatite beads that would appear to be Harappan in origin as well as beads and tools evidently made from agate available in the Gangetic region. If the steatite beads were indeed coming from the west then agate from sources in the east could very well have been moving in the opposite direction."

The presence of certain floral remains in the Middle Ganga Plain and at nearby sites is important. These comprisewheat-barley and other crops (Tewari *et al.* 2008; Saraswat 2004b) noted in the early half of the third millennium B.C. at Lahuradewa, Damdama and Panr, grape (*Vittis vinifera*) in the north-western region at Imlidih Khurd (pre-1300 B.C.) and Narhan (*c.* 1300-700 B.C.), dates (*Phoenix dactylifera*) from the same area at Narhan (*c.* 1300-700 B.C.) and jackfruit or Katahal (*Artocarpus heterophyllus* Lamk. which is indigenous in the forests of Western Ghats) at Narhan and Senuwar between *c.* 1300-800 B.C. (Saraswat 1993: 37-41, 2004a: 471-72; Saraswat *et al.* 1994: 277, 326), iron wood (Nag-kesar; *Mesua ferrea* L. an element of evergreen forests in Assam and Bengal) between 1950-1300 B.C. and deodar (*Cedrus deodara*, a Himalayan timber which occurs at the elevation of 4000-8000 feet) between 1300-700/600 B.C. at Senuwar (Saraswat 2004a: 519, 521). This evidence attests to established long distance contacts between this region and distant regions for a long time period. Such contacts are also seen in the presence of rice (*Oryza sativa*) (Sraswat 2005; Saraswat and Pokharia 2003), and silk (A. *assamensis* and *A. mylitta*. "The particular morphological characteristics of each type of silk are due to the unique shape of the silkworm's orifice when ejecting fibroin during cocooning. *A. assamensis* is found in the high altitudes of the northeastern Subcontinent, and *A. mylitta* is found along the tropical west coastal region. However, both regions are at a considerable distance from the Indus Valley." (Good *et al.* 2009: 3-4). At Harappan Sites from *c.* 2450 B.C. onwards and mangoes and citrus fruits (plausible origin in northeast India) in southern India (Fuller *et al.* 2009). This shows the potential of the study of above representative remains in tracing the long distance interconnections.

The presence of domestic goats and sheep in the areas to the east and south of Harappan zone attests to the significance of faunal remains in this regard. The presence of particular types of pottery (such as Harappan, Ahar, NBPW, PGW, etc.) also provides important clues of contacts. Considering this evidence, together with recent finds (barley, wheat, steatite beads, *Capra*, copper arrowhead, etc.) (Tewari, *et al.* 2008), one may establish links between Middle Ganga Plain people and Harappans. This indicates the strong possibility of interactions between northeast India and the Harappan Area in the third millennium B.C. These clues underline the necessity for focussed research in the area lying between the Middle Ganga Plain and western India on the one hand and between the Middle Ganga Plain and the northeast on the other. Archaeological remains from the Middle Ganga Plain sites of this period should also be looked at with this perspective in mind.

Motichandra's (1953) excellent book in Hindi, *Sarthavah* deals with ancient Indian routes, and is based on ancient literature. The famous traveller, Rahul Sankrityayan, (Tewari 1993) profusely delibrateson many contemporary and old routes. Medieval and British records (Chakrabarti 2001: 16; 2005: 120-37) also provide very useful information. Some travel accounts written during this period serve as the primary source of information. In this regard mention may be made of popular writings such as *Manjha Pravas* by Godse (Nagar 1957) in Marathi and *Agneya Tirtha Hingalajgarh* by Devadatta Sastri (1978) in Hindi. These travelogues are based on first hand experiences of travelling from Maharashtra to north India in 1857 and from Karachi to Hinglajgarh in Balochistan in 1940 respectively. Some ancient Indian routes have been traced on the basis of comparative cultural material and literary sources (Verma 1978; Habib 1982; Chakrabarti and Lahiri 1986; Chakrabarti 1990; Lahiri 1992). It was J.D. Beglar (Chakrabarti 2005: 18-20) who initiated the study of ancient routes on the basis of archaeological fieldwork during 1871-72. After him, no substantial research was conducted for well over a century. Recently (during the last decade of the twentieth and beginning of this century), this approach has been followed in a wider perspective (Chakrabarti *et al.* 2003, 2002, 2001; Chakrabarti 2010, 2005, 2001, 1990; Prasad 1977). They explored the Ganga Plain, Deccan and further south in order to mark ancient sites and to assess the geographical feasibilities of ancient routes. On the basis of this work and based on published literature, they suggest a broad framework for such routes, linking ancient sites across the Ganga Plain and those emanating from this area towards the Deccan. However, considerable work may still be conducted in this field, at macro and micro levels particularly in terms of specific chronological contexts. Well-planned, detailed and focussed field work, along probable land and sea routes in all these regions needs to be carried out.

Across the Borders

The study of floral remains has played a very significant role in providing an insight regarding direct or indirect contacts across the modern South Asian border. The most important development in this respect is growing evidence for the presence of some American plants, considered to be Portuguese introductions in the Old World during Pre-Columbian times in India. Saraswat (2007, 2008) has drawn our attention towards following of them:- Custard apple (*Annona squamosa*) is noted at some sites located in the Indo-Gangetic plains and in the north Vindhyan hills, dated from *c.* 1500 B.C. onwards (Saraswat *et al.* 2008), *Amaranthus* sp. in the Middle Ganga Plain dated to 2000 - 1800 B.C. and 1300 - 800 B.C. (Saraswat 2004a: 510; Saraswat 1993: 39-40), Mexican poppy (*Argemone mexicana*) in Trans Ghaghara area (Sarayupar at Narahan) at *c.* 1300 B.C. (Saraswat *et al.* 1994: 333-340), cashewnuts in the second century B.C.; pineapple of Brazilian origin during the 5th century AD, chilli–pepper during the 6th-8th centuries AD; Nagalingam or cannon ball (South America) in medieval times; sunflower of Central South America during the 10th century AD; Central American *Monstera* from the 11th to 13th centuries A.D. and maize cobs of Mexican origin in the11th and 12th centuries A.D. (Saraswat 2007, 2008; Gupta 1996). It is largely regarded that tobacco reached India after its introduction in post-Columbian period. However, Ashraf (1985) has traced its popularity in this region in pre-Columbian times. In archaeological finds it has been found at Sanghol in the context datable to early centuries A.D. (personal communication to the author). A group of dedicated scholars focus on each issue publish useful material for further research in an exclusive journal entitled *Pre-Columbia.*

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Remains of some plants native to Southeast Asia have been found at different sites of South Asia, e.g. job's tear (*Coix lachryma-jobi*) at Senuwar (South Bihar) dated to *c.* 2200-1950 B.C. and at Balathal (South Rajasthan) dated *c.* 2350 - 1600 B.C. (Saraswat 2004a: 497-98),*Areca catechu* (betel nut) at Watgal (2700-2300 B.C.) (Deavaraj *et al.* 1995: 61), sandalwood, and coconuts in southern India and banana in the Harappan Civilization (Fuller *et al.* 2009). On the other hand the presence of Indian mango (*Mangifera indica*) has been marked in Borneo around mid-Holocene context (Barker 2009). These finds provide clear evidence for the early direct or indirect across border contacts in antiquity. Ample information is available on Indian Buddhist monks travelling to China via northwest, northeast and southeastern routes from *c.* 2nd century B.C. onwards. These routes must have been opened much earlier. What is required in this regard is to probe these alignments foridentifying archaeological markers and geographical probabilities during pre-2nd century B.C. period. In a recent presentation on the study of ancient trade routes from India to Korea, Byung-Mo Kim (2010) stated in a meeting at Lucknow that:

"*Samkuk Yusa*, the chronicle of 3 kingdoms, compiled in 13th century, states:

July 28, in 48 (A.D.) a boat with red sail landed at port of Karak. 20 people landed. A woman introduced herself to the king. 'I am the princess of Ayodhya. My name is Huh, Whang Ok and I am 16 years old.' She brought many goods and the king married to her. They lived long and 10 boys and 2 daughters were born who became the ancestors of Kim Clan and Huh Clan, the largest population – outnumbering 6 millions in Korea. The tomb of Huh Whang Ok is at Kimhe city. On the tomb stone her posthumous name is the queen of Boju (in Chinese). On the basis of his study on the archaeological and folk evidences Prof. Kim is of the opinion:

'Huh family left Ayodhya and arrived at Boju China. And they settled down there for some time until Boju was colonized by the mighty Han China in 47 A.D. The resist by the Indian population failed against Han and 7, 000 people escaped from their second home land to Chiang hsia (present Wuhan), a city along the Yangze River. Next year princess Huh Whang Ok sailed across the Yellow Sea and landed in Korea. The road travelled is called in Chinese 'Ancient Tea and Horse Route.' They were traders travelling on horse' or donkeys back through the rocky mountains and crossed over the deep river. They left wherever they stayed the twin fish symbols praying for their security and longevity. During personal conversation regarding the above route Kim also mentioned that according to some Chinese sources one of the sons of Ashoka had established a colony in Southern China, which was later occupied by the mighty Hans.

Some scholars present in the Lucknow meeting warranted more evidence from Kim to corroborate this hypothesis. The author of this paper feels that a focussed study of the available archaeological remains along the proposed route may be very rewarding not only for assessing the hypothesis being submitted by Prof. Kim, it may also reveal other available evidences for understanding the phenomenon of early interactions between Middle Ganga Plain and mainland China.

Contrary to the long prevailing view regarding the dispersal of wheat/barley in China from west to east along the silk route, new data on archaeobotany generated by Zhijun Zhao (personal communication, Dr. Zhijun Zhao) indicates that these cereals appear much earlier (*c*. 2500-2000 B.C.) in eastern China in comparison to northwestern China (where there date is *c*. 2000 - 1000 B.C.). This evidence suggests the strong possibility for the spread of these cereals in the opposite direction, i.e. from east to west. Three possible routes for their dispersal in China, suggested by Zhao, may be from the west South Asia via north-western China (Tarim basin) and via a sea route encircling peninsular India and leading towards eastern China (Canton/Shanghai) respectively (personal communication, Zhijun Zhao). Based on recent finds on links between Middle Ganga Plain and the Harappan Zone, we may add another probable route passing through Middle Ganga Plain and northeastern India via northern Myanmar to Yunnan and further north, with respect to the spread of wheat and barley.

In view of the recently reported presence of silk at Harappa and Chanhudaro from 2450 B.C. onwards, the observation submitted by the investigators is notable in the present context: "What has not been adequately considered in the literature, however, is the possibility that a non-Chinese (and *de facto* wild) species of silkworm that produced workable silk was known and used in antiquity, and that the rare instances of silk that have been discovered far outside of China, and that date to before Wu-ti's trade relationship with the West began, may have, in fact, been produced indigenously or imported from regions other than China. The evidence presented here now suggests that early sericulture did in fact exist in South Asia and was roughly contemporaneous with the earliest known silk use in China." (Good *et al.* 2009: 7-8)

Taking clues from the above discussion, the formulation of research projects would certainly be a very significant line of investigation. Investigations beyond the India, in Southeast Asia, south China, Tibet, Central Asia, East African coast, Persia, Middle East and Eastern Europe, are essential to trace the phenomenon of our ancient cultural interactions with these regions within a broader perspective. We must remember that there was no restriction on travelling or wandering over this vast mass of land in ancient times, and also that no culture developed in isolation. At present, considerable information is available about the Harappan trade with west Asia during the 3rd millennium B.C. However, we do not have enough data to understand that what happened during the 2nd millennium B.C. Trade might have slowed down after the Harappan decay but there is a lower probability of its total breakdown. Contacts between western and eastern Indian coasts and east African and Pacific coastal areas, have been investigated to some extent on the Indian side, but we should also look for presence of Indian cultural material elsewhere.

Antiquity of NBPW

Since the Northern Black Polished Ware (NBPW) has been associated with the beginning of the second urbanisation in the Middle Ganga Plain, its antiquity is of special significance. On the basis of stratigraphic considerations, Marshall proposed a date of *c.* 800 B.C. as a lower limit. Subsequently an age estimate of *c.* 800 - 600 B.C.was suggested with a general inclination towards the later age.

Most archaeologists and historians place this pottery between *c.* 600 - 200 B.C. As this is considered reliable, most archaeologists do not care to collect charcoal samples for further dating. In view of recent finds, it should be one of the major issues for generating more data. It would be worth recalling here, that the dating of the Early NBPW Phase of Kausambi, the possibility of a date of earlier than *c.* 650 B.C. was suggested by Mandal (1972: 185). A new set of radiocarbon dates for the NBPW deposits, going back to *c.* 800 B.C. and even earlier in some cases, has emerged from Jhusi (Misra *et al.* 2003), Malhar and Raja-Nala-ka-tila (Tewari *et al.* 2000), Ayodhya (Kumar 2005), Gotihwa (Verardi 2007: 17) and Jaufar Dih (Saran *et al.* 2008), which has once again reopened the question of the antiquity for the beginning of this pottery. Radiocarbon dates and stratigraphic contexts are clearly indicate the presence of a pre-800 B.C. proto-NBPW phase at some of these sites. Verardi (2007: 17) has noticed the presence of proto-NBPW at Gotihwa in 900-800 B.C. and observed "that Proto-NBPW may exist at all the NBPW sites of the region dated to or earlier than the 9th-8th century B.C." He has rightly pointed out that careful observations by excavators dealing with the early sites of this region may reveal the presence of proto-NBP pottery at other sites too. This evidence indicates that this wonderful pottery may be at least a couple of centuries older than *c.* 800 B.C. Therefore, one should watch out for the appearance of NBPW in lower levels during excavations particularly in the Middle Ganga Plain sites and one must try to obtain more scientific dates for the lowest NBPW deposits.

Another important aspect is the dating of this pottery at sites distant from the Middle Ganga Plain. Generally it is believed that this cultural phase arrived in other regions during the Mauryan period. It should be noted that this pottery is believed to have been produced in its core area in the Ganges valley from pre Mauryan times and its dispersal must have happened during the same period. The quality of NBPW sherds and available ^{14}C date (TF-987: 2755 ± 95 BP (805 B.C.) from deposits at Korkai, Tamil Nadu attests to this (IAR 1969-70: 68).

Further Investigations at Previously Excavated Sites

It may be worth noting that there had been a trend to establish the lower age limits ancient cities such as Rajghat (Varanasi), Srawasti, Piparahwa/Ganwaria and Jhusi etc., at around 800 B.C. Recent research carried out in surrounding areas prove that a many sites were inhabited much earlier. In view of these developments, the chronology of some of these sites needs to be reviewed. The chronology of lower deposits at some important sites such as Ahichchatra and Sohgaura (Uttar Pradesh), Sonpur, Taradih and Rajgir (Bihar), Malhar (Chhatisgarh), Prakash, Ter and Paithan (Maharashtra), Watgal and Sannati (Karnataka), Algankulam and Korkoi (Tamilnadu) etc. are largely based on extrapolation. Therefore, there is a need to re-excavate these sites with an objective to obtain reliable dates.

Some previously excavated major sites require large-scale re-investigation in view of recent developments. Rakhigarhi (Haryana) may be one of such sites. Considering the extent and its significance, further excavations at this site under a specific National Project would be of importance. Similar approaches may also be suggested regarding the medieval sites, such as Ahar in district Bulandshahar in Uttar Pradesh.

Exploration and Salvage Operations

More exploration and documentation of the ancient sites and monuments is urgently needed. Although extensive explorations have been carried out all over the country an appraisal of brief reports mainly published in IAR, shows that data such as specific locations and geo-coordinates are absent. Details comprising the possible extent of the ancient site, cultural deposits, area-wise concentration, and particulars of medieval and post medieval remains are usually not mentioned in such reports. Therefore, more focused exploration along with recording details should be immediately undertaken. The use of GPR and other modern devices may be very useful. Detailed explorations to plot ancient sites on a map is of utility in studying regional settlement patterns. Works undertaken in Gujarat (Chitalwala 1979), Ganga-Yamuna Doab (Dikshit 1979), Kanpur (Lal 1984), Rajasthan (Hooja 1988), Allahabad (Erdosy 1988), Tapi Valley (Shinde 1998), and Ganga Valley (Chakrabarti 2001, 2007) are the notable examples in this regard. Catalogues of ancient sites in Tamil Nadu along with excellent maps showing their specific locations (Rajan 2009) are welcome additions in this regard.

The extent of developmental schemes carried out at different levels in the country and ever growing demographic pressure has created a serious danger for the destruction for an enormous number of archaeological sites. Therefore it has become imperative to have a mechanism for assessment of their impacts on archaeological sites and a well thought follow up action for their exploration, documentation, shifting and excavation (as per-requirement). No objection from concerned archaeological departments may be mandatory before mplementation of any developmental project. The provision for a certain proportion of money may be made within the budget of developmental schemes, exclusively for archaeological assessment and related work.

Temples and Sculptures

Over the past 200 years, considerable data has been generated in terms of documentation of temples.. The *Encyclopaedia of Indian Temple Architecture,* published by the American Institute for Indian Studies, may be mentioned in this regard. Dimensions, plans and elevations of most temples have been described. The terminology used for describing their parts and mouldings has been taken from some architectural texts such as *Samaranganasutradhara* in north India. Their classification is largely on chronological considerations. It would be more rational to study a temple from the point of view of its origin and evolution and considering developments which occurred from time to time, as has been done regarding the *Bhumija*, *Sarvatobhadra*, *Valabhi* and some other type of temples (Deva 1975; Tewari 1999, 2011; Singh 2000). From an archaeological perspective, their relation with human settlements, surrounding landscapes, and the genesis of each type of temple form should be studied. The documentation of ancient temples and their remains with respect to contemporary settlement sites in the north Indian alluvial plains, (where most ancient temples are in a terrible condition owing to various reasons), may provide very significant insights regarding various aspects of ancient temple architecture and religious beliefs prevailing in these respective periods. Apart from this, since the terminology presently in use, in north India, to describe temples is largely based on Central Indian texts, there is a need to investigate whether other regional architectural texts are available.

Identifying sources of stone and stone quarries, exploited in the construction of sculptures and temples in different regions may be another important line of investigation, in order to identify the major centres of arts and phenomenon of export of art objects to different regions. In Uttaranchal, most researchers have tried to trace influences on ancient temples and sculptures of this part of the Himalayas, from distant areas such as eastern India and Mathura. However, hardly any attempt has been made to look into the traits contributed by this region to the temple and sculptural art, and whether sculptures made here, found a place in the plains or beyond.

Dating of Terracotta and *Caturanga*

There may be many issues related to art and architecture to be taken up by the competent experts. One of them is the problem of dating terracotta art. Generally stylistic considerations are applied in this regard. Most archaeologists do not give due attention to the specific provenance of terracotta figurines during excavations and place them in a general chronostratigraphic frame. A good number of high resolution radiocarbon dates of associated charcoal samples from close intervals and direct AMS determination on the organic material, if available, in the core of clay used to make terracotta figurines may solve this problem to the extent of more certain basis. This approach would also be helpful to another puzzle to find out the 'Origin of Chaturanga in India', which has become a prime concern for a group of German scholars (Manfred 2000). They are working on the hypothesis that this game (*caturanga* a game to be played on game boards with 64 fields - *astapada*): went to Persia during the reign of *Sarvavarmma Maukhari*, the king of Kanauj during the late 6th century A.D. Kannauj (Manfred 2000; Syed 2001). The precise dating of the particular type of terracotta gamesmen (being associated with this game) found in archaeological context may be very helpful in deciding this issue.

Scientific Collaboration

A very well planned strategy comprising short and long-term goals with a multidisciplinary approach is a prerequisite to address the above issues. Collaboration with the experts from geo-sciences, palaeobotany, palaeontology, palynology, DNA study and scientific dating is a must for such projects. We need experts from each of these disciplines in every team which intends to tackle these issues. A real problem arises here, because we have failed to generate the required expertise in these sectors. At the moment we have a very few trained and experienced specialists available in our country in these fields and if we seriously initiate in this direction it will take at least five to ten years to give some results. Geology, botany and zoology departments in Universities and Government institutions may serve as specialised centres in this regard provided reasonable job prospects with a respectable salary may also be created to attract the bright students towards this captivating subject. To begin with, at least crash courses, may be initiated for working archaeologists in the Institute of Archaeology (Archaeological Survey of India) for collecting the faunal/floral remains and soil samples for further studies. The problem of scientific dating also needs the same approach, however, till the establishment of our own facilities to some extent we may consider to tap the expertise available in these fields world over. Unless we have high-resolution data based on AMS and other scientific dating methods our finds will hardly be accepted on a sound footing. In any case we will have to have teams of indigenous workers if we really want to tackle this problem effectively. The Archaeological Survey of India, Department of Science and Technology and University Grant Commission should jointly take up this challenge.

Sustainable Development

The issue at hand is to generate more data to understand human response to climatic events, to take lessons in from the past mistakes and to take leads from the positive traditional measures evolved in this process in order to develop a sustainable development plan for future. This is essential in view of the ever growing furious environmental hazards and devastating crunch of natural resources such as scarcity of water resources and global warming, and also for maintaining the peaceful ways of life which are endangered in the modern world.

Acknowledgements

The author is sincerely grateful to the Indian Society for Prehistoric and Quaternary Studies for providing me with the opportunity to deliver this address. Special thanks are due to Dr. K.S. Saraswat for inspiring me to elaborate on the above-mentioned issues in a full-length paper. Gratitude is also due to my colleagues for their kind support and suggestions extended from time to time, and to Dr. R.N. Singh for granting the permission to publish the AMS dates from Alamgirpur.

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Walimbe S.R., *et al.*, *Man and Environment* XXXVI(1): 31-70 [2011].
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Hitherto Undescribed Megalithic Burials from South Asia: The Skeletal Record

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Abstract

India, Pakistan and Sri Lanka have offered archaeologists and biological anthropologists a wealth of information on prehistoric human inhabitants of the Indian Iron Age. Hitherto undescribed or partially examined skeletal remains from this cultural tradition are from burial sites, of which some are associated with megalithic monuments. The burial sites are named after towns and villages near the loci where human skeletal remains have been found. Several burials from Andhra Pradesh were excavated by teams under the supervision of the Department of Archaeology of the Government of Andhra Pradesh. Among some of the excavated sites, in the Krishna District of Andhra Pradesh include Agripalli, Kadambapur, Tenner and Veerabyine Kunta, as discussed in the present study. Morphometric and statistical analyses of human remains from this part of India include data comprehensively reported for the first time by the present authors. It is concluded that comprehensive results of our investigation when considered along with those from previously published data about Indian Iron Age skeletal and dental series support this hypothesis: the Iron Age specimens from peninsular India reveal phenotypic heterogeneity. There is no scientific evidence that Iron Age peoples of peninsular India were "racially distinctive" and/or migrants arriving from lands outside the Indian subcontinent. A different hypothesis has been favoured by some past and present investigators of South Asian prehistory, namely that megaliths, specific burial practices and iron technology were inaugurated by foreign invaders arriving from beyond the shadows of the Himalayan mountains, perhaps from Central Asia. These migrants eclipsed the native Neolithic populations. Do archaeological and skeletal scientific observations support the later conjuncture?

Introduction

The Indian Iron Age is South Asia's last prehistoric period. A number of archaeological sites of this cultural tradition have been located (Fig. 1). Iron metallurgy was introduced into northern India from Near Eastern sources by 1000 B.C.; iron arrived as late as 500- 350 B.C. to 50 A.D. in southern regions of the subcontinent and in Sri Lanka (Tripathi 2001). The onset of the Early Historic Period was contemporary with and later replaced the Indian Iron Age from 500 B.C. to 500 A.D. (Morrison 1997). The theory that iron technology was invented independently in India and did not diffuse from the Near East, has provoked a continuing debate among archaeologists (Agrawal and Kharakwal 2003; Banneriee 1965; Chakrabarti 1992; Childe 1947; Furer Haimendorf 1945; Leshnik 1974; Possehl 1999, Subrahmanyam 1987, 1989, 1997; Yazdani 1917). Arguments supporting theories of iron technology as having a unique origin on the subcontinent are often allied with demographic hypotheses concerning venerable concepts of "racial" origins and mass migrations of populations.

However, it was not the discovery of iron artefacts in South Asian archaeological sites that ignited the interests of foreign and Indian advocates of an Indian Iron Age; rather, it was the presence and diversity of megalithic monuments dominating the South Asia landscape. Some of these stone structures reminded foreign visitors of the megalithic monuments in various parts of Europe (Stonehenge, Carnac, etc.). Associated with many subterranean and urn burials were faunal remains of various species, iron objects and a distinctive pottery with painted decorations. A number of systems of megalithic classification have been proposed by archaeologists (Khan 1963, Krishnaswami 1949; Mohen 1990), but the similarity of some megalithic structures in

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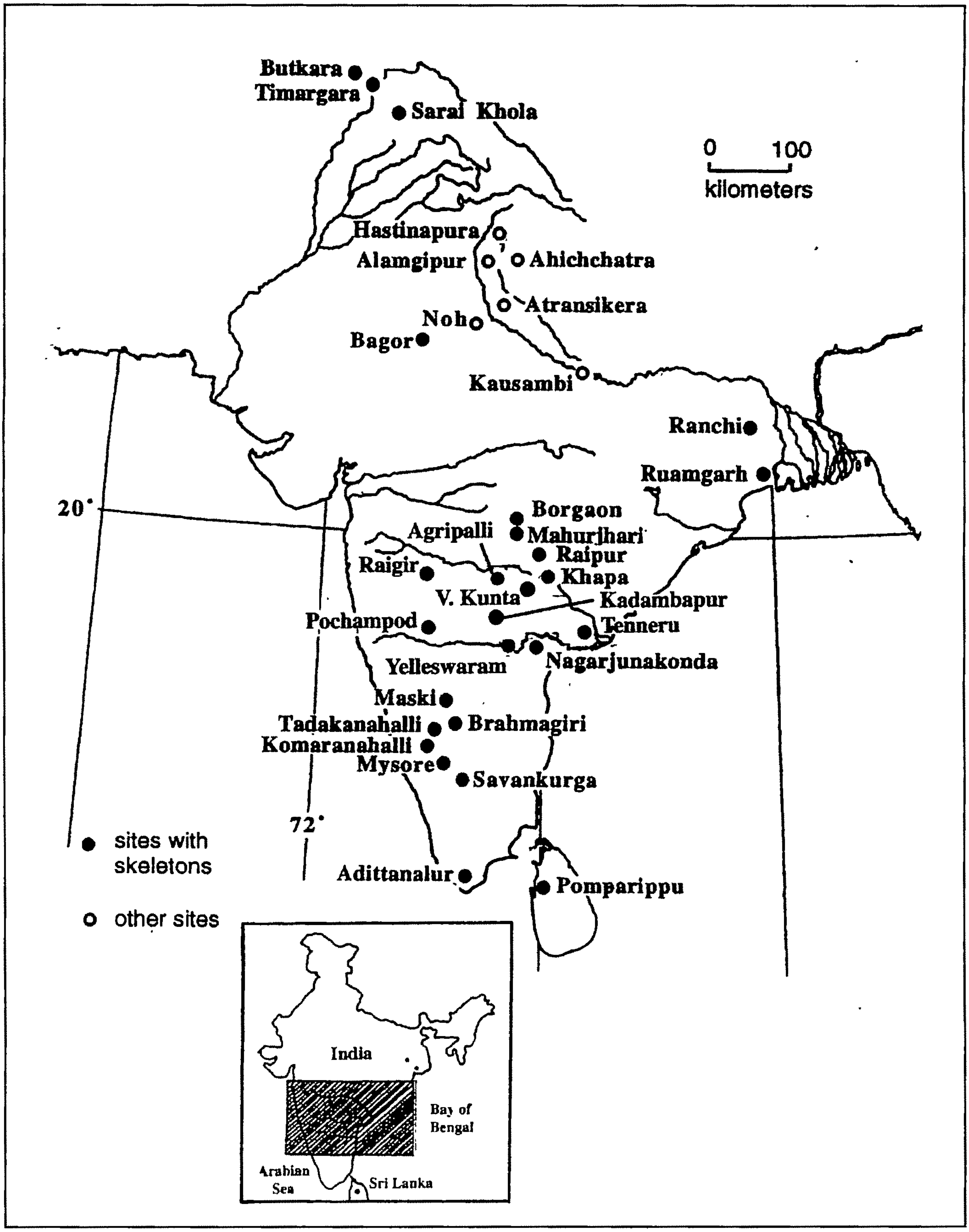
Received : 12-07-2010
Revised : 31-07-2010
Accepted : 17-12-2010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Sri Lanka

Fig. 1: Map of South Asian Iron Age sites.

India and Sri Lanka (Deraniyagala 1992) to those found in lands outside of the subcontinent has generated internationally a relatively acceptable list of types (alignments, barrows, .cairns, dolmens, hood stones, menhirs, orthostats, posthold cists, rock-cut chambers, stone circles, etc.).

By 1820 (Babington 1823) British civil servants, military officers, antiquarians and archaeologists began examining and publishing their discoveries (Kennedy 2000). Skeletal remains within the megalithic complexes were given minimal attention, although by 1850 Colonel P. Meadows Taylor (1851) was beginning his study of these upright stone structures, which were visible on the landscape, and the boulders arranged as circles resting on the ground. The majority of burial locations he examined were located in the Deccan. A skull removed from a cairn at Jiwurji (Jewurgi, Jewurge) near the town of Farezabad was described by Meadows Taylor whose report included the first published drawing of a prehistoric skeletal specimen from India (Meadows Taylor 1873: 344, Fig. 2). There followed a long sequence of Indian, German, French and British involvements with Indian Iron Age sites among whom some amateur and trained archaeologists excavated them and attempted to preserve the prehistoric human skeletons they encountered.

Thousands of megalithic burial sites have been vandalized by treasure-hunters, past and present, with subsequent loss of skeletal remains. Among those which have been salvaged and for which there exists a published morphometric record are the listed in Table 1. This list does not include all published or unpublished records on the biological anthropology of recovered Indian Iron Age human remains observed and collected over the past two centuries (Bose 1966; Caldwell and Kennedy 1984, Kennedy *et al.* 2002). Governmental reports, newspaper articles, private letters, notes never intended for publication and lecture topics would provide additional insights into this terminal stage of South Asian prehistory. It is for the purpose of amplifying the account of Iron Age skeletal biology that the authors offer their data concerning the hitherto undescribed contents of megalithic burials. These new morphometric analyses provide an opportunity for other investigators to enhance the sizes of their skeletal and dental series for comparative and multivariate statistical analyses (e.g. Morrees 1957).

Furthermore, the authors seek to test the hypotheses that Iron Age populations of the subcontinent reveal phenotypic homogeneity or heterogeneity. The former thesis is based upon the identity of the megalith-builders as a "racially distinctive" enclave formed by migrants whose origins lay outside of the subcontinent (Cappieri 1961; Sarkar 1972.)

Methods and Material

Preliminary cleaning and inscription of burial numbers using black India ink on the bones had been done, in most cases, at the time of their excavations.

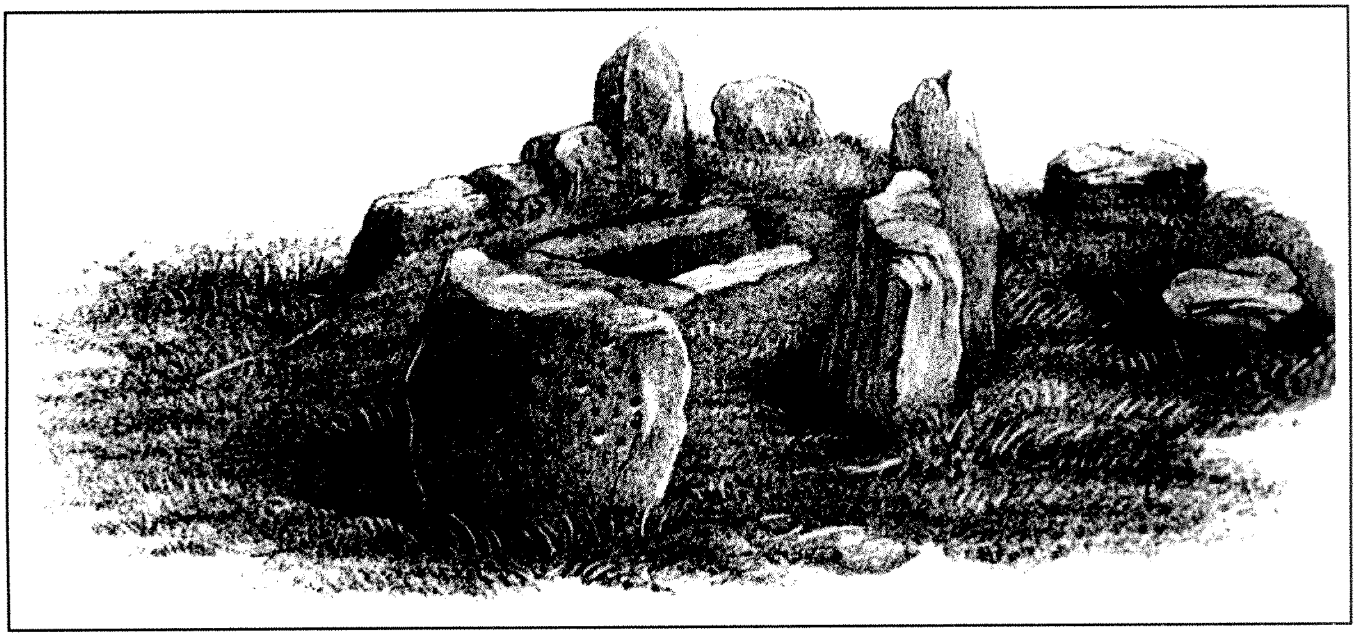

Fig. 2: Indian Iron Age "Barrows" near Nagpur

Table 1: List of the Iron Age Megalithic sites in South India with published skeletal record

Site Name	Location/(State/Nation)	Published Source
Adittanallur	Tamil Nadu, India	Chatterjee and Gupta 1963; Kennedy 1986; Zuckermann 1930
Agripalle	Andhra Pradesh, India	Rao 1984; Rao *et al.* 1996
Bhagimohari	Maharashtra, India	Walimbe 1990
Bhimbetka	Madhya Pradesh, India	Kennedy *et al.* 2002
Borgaon	Maharashtra, India	Walimbe 1990
Brahmagiri	Karnataka, India	Sarkar 1960, 1972
Butkara	Northwest Pakistan	Antonini 1963; Bernhard 1967
Kanyathirum	Andhra Pradesh, India	Walimbe *et al.* 1991
Khairwada	Maharashtra, India	Walimbe 1990
Khapa	Maharashtra, India	Rao 1970
Kodumanal	Tamil Nadu, India	Mushrif *et al.* (in press)
Komaranahalli	Karnataka, India	Caldwell and Kennedy 1995
Kudatini	Karnataka, India	Mushrif *et al.* 2003
Mahurjhari	Maharashtra, India	Lukacs, Caldwell-Ott and Kennedy (in preparation); Lukacs 1981; Rao 1973
Maski	Karnataka, India	Sarkar 1972
Mysore	Karnataka, India	Bain 1890
Nagarjunakonda	Andhra Pradesh, India	Gupta *et al.* 1970
Naikund	Maharashtra, India	Kennedy *et al.* 1982
Pappinayakkanpatti	Tamil Nadu, India	Walimbe and Selvakumar 1998
Pochampad	Andhra Pradesh, India	Kennedy 2002
Pomparippu	Western Sri Lanka, India	Begley *et al.* 1981; Hocart 1924; Lukacs 1976; Lukacs *et al.* 1981
Raigir	Andhra Pradesh, India	Hunt 1916, 1924; Kennedy 1965, 1990, 2000a
Raipur	Maharashtra, India	Walimbe 1990, 1992; Mohanty and Walimbe 1993
Ranchi	Bihar, India	Mitra and Bose 1936
Ruamgarh	Bihar, India	Kennedy 1972
Sanur	Tamil Nadu, India	Bannerjee and Saundara Rajan 1959; Bose 1959
Savankurga	Karnataka, India	Branfill 1881
Sarai Khola	Northwest Pakistan	Bernhard 1969
Taddakanahali	Karnataka, India	Caldwell and Kennedy 1995
Timargarh	Northwest Pakistan	Bernhard 1967, 1968
Yelleswaram	Andhra Pradesh, India	Gupta and Dutta 1962; Kennedy 2000b; Sarkar 1972

Some cranial and postcranial remains in our series had not received this attention, thus it was necessary for the present investigators to continue the process of removing the dirt matrix from each specimen and creating an updated catalogue. This necessitated some repair of fragmentary bones. Loose teeth did not bear numbers, but teeth remaining in maxillary and/or mandibular alveoli could be identified with the bones which bore specimen numbers. Laboratory studies of the majority of the materials from Andhra Pradesh were conducted at the Department of Archaeology and Museums, Government of Andhra Pradesh, Hyderabad.

Measurements of bones and teeth were based upon anthropometric procedures defined and coded according to Knussmann's (1988) standards based and expanded upon earlier texts by Martin and Saller (1957). These were the procedures followed by the two of the authors (Caldwell/Ott and Kennedy) with supplementary methodologies favoured by Buikstra and Ubelaker (1994) and Wolpoff (1971). Numbers in parentheses following the description of each measurement refer the reader to Knussmann's anthropometric standards in which each mensural procedure is coded. Instruments included spreading and sliding callipers calibrated to cm and mm units, Helios calipers graduated to tenths of a mm and used for dental specimens, a palatometer, a Molleson craniophore, steel metric tape and an osteometric board. Craniometric and osteometric data are given in Table 2 and 3. Certain bones and teeth were photographed but radiography was not feasible under the circumstances of the laboratory facility. All estimates are in parenthesis.

Abbreviations accompanying metric measurements are: RS = right side; LS = left side; M = median plane; L = length; B = breadth; H = height; T = thickness; circum = circumference; A/P = anterior / posterior; Lat. = lateral. For the permanent dentition I = incisor; C = canine; P = premolar; M = molar. For deciduous dentition lower case letters are used: i = incisor; c = canine; m = molar. Numbers in superscript and subscript indicate maxillary (upper) and mandibular (lower) teeth.

Dental measurements include mesio-distal (MD) and bucco-lingual (BL) diameters using the procedures defined by Moorees (1957). Cross-sectional crown area (CA), crown index (measures of crown shape, CI) and crown module (measure of crown module, CM) are calculated.

Indices (singular is index) are ratios of metrical value dimensions x 100, which provide information about morphological form of one or more bones.

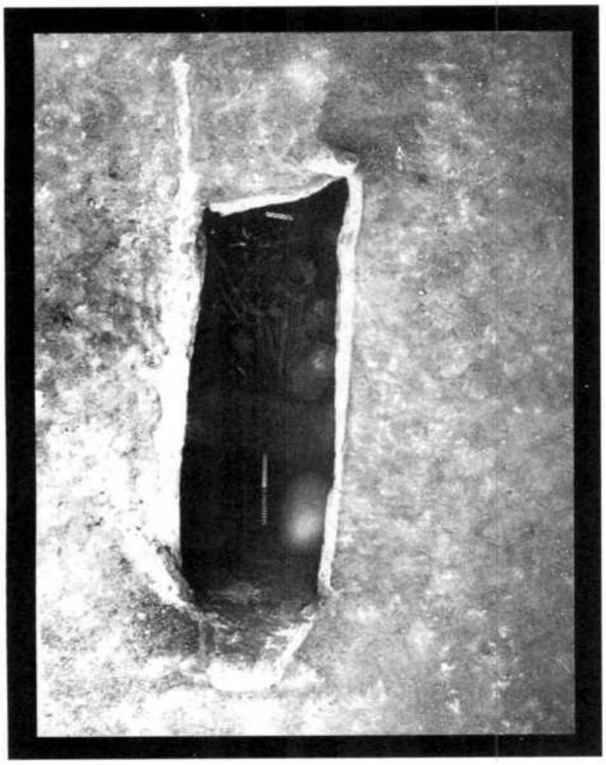

Fig. 3: Agripalli: Cist II

Thus the cranial index = maximum cranial B divided by maximum cranial L x 100. Classifications of indices are included in the text. Estimates of cranial capacity for male and female specimens are based upon the formulae of Lee and Pearson (1901). Estimations of living statures are based upon long bone length measurements and Trotter's (1970; Trotter and Gleser 1952) regression formulae. Dental measurements were taken by both the first and the last authors who employed Wolpoff's (1971) standards. Degrees of muscular / skeletal robusticity of individual skeletal bones in our series were assessed by metric analysis as well as by morphological observations of remodeled bones and teeth, response to habitual behavoural activities induced by patterns of stress in subjects (Wilczak and Kennedy 1998). The comparative dental study by Walimbe and Kulkarni (1993) discusses adaptive features of human dentition, ancient and modern.

Description of Human Remains

*Agripalli (Agiripalli, Agiripalle, Akiripalii)**
Agripalli is located in the Nuzvedu tehsil of Krishna district, about 30 km from the city of Vijayawada. The site was discovered by T.V.G. Sastri (IAR 1969-70; 1974-75:3). It is a cist burial complex located at the foot of the western side of Sobhanagiri hill. Most burials are devoid of boulder circles, but cists, sarcophagi, and urns are present, many with commingled remains. Funerary pots contained ashes and fragmentary human bones with some isolated teeth; legged sarcophagi containing human remains were reported by Subrahmanyam (1987, 1989).

Excavated in Krishna district in the field season of 1970-71, seven burials were exposed. One of the two cists (Megalith II) contained the cranium of an adult male (ca. 35-50 years of age at time of death), two other adult male cranial bones and a calotte identified as that of an adult female. Commingled with these four crania are severely eroded postcranial bones and teeth (IAR 1980: 5) (Fig. 3 and 4). The reports in IAR cited below provide the following descriptions of Agripalli's archaeology and associated human skeletons:

"Megalith 1 was a cist-burial with cairn packing. The circle stones were either missing or were not provided … as the raw material is not available in the near vicinity". The cist is rectangular on plan having the eastern and western orthostats (1.80 m) longer

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* This part is contributed by S.R. Walimbe

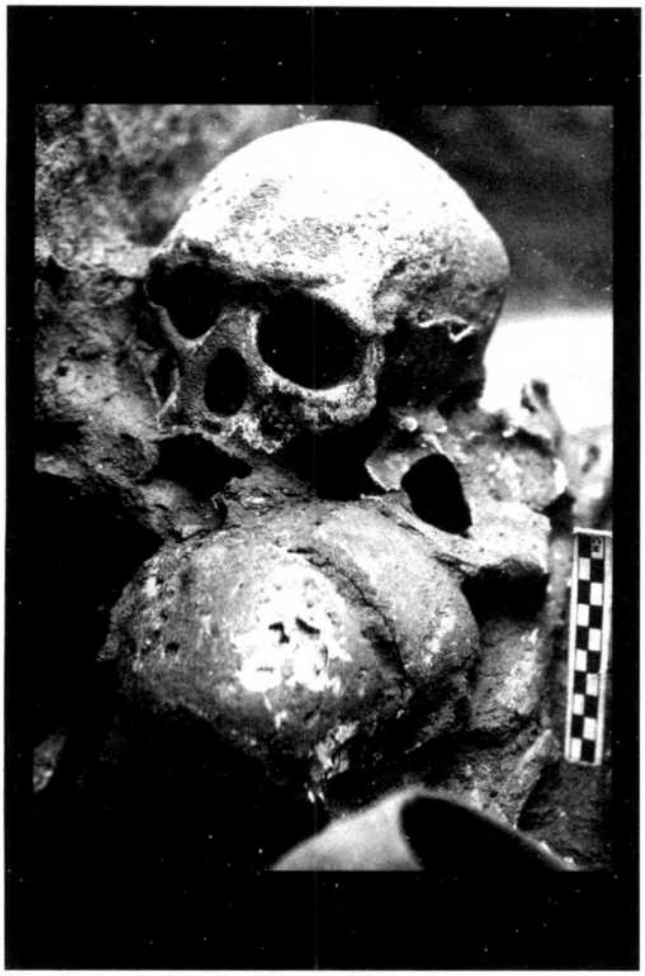

Fig. 4: Agripalli: Skull I and III *in situ*

than the southern and northern ones (0.75 m). The chamber is not provided with a port-hole, but has a floor slab at a depth of 1.15 m. No capstone was found. The deposits inside the cist chamber included pottery of red and Black-and-red Wares, a few calcined bones and an iron object. "

"The cist II (Meg II) was tightly capped by four rectangular granite slabs. The orthostat of the cist measured about 1.45 m. The northern orthostat stands to a height of 1.45 m to serve as a head stone. The cist consisted of 4 skulls. Two skulls were placed slightly overlapping each other and touching the western slab. Two other skulls were placed near the eastern slab. In between these two groups were placed the longer (limb) bones such as femur, tibia and fibula. In front of skulls I and II the hand bones, viz. ulna and radius were found. Another set of femur- tibia-fibula was found underneath the skulls III and IV. The funerary ceramic assemblage consists of red ware pot about 10 cm in height with thickened and slightly everted rim, on which a thin pale red slip is visible. The other pot is ill-fired black-and red ware bowl with featureless rim. The collection also included a lid-cum-bowl of pale red ware. "

"Megalith 3 was also similar to the above ones, and yielded pottery of the typical Black-and-Red vases with flanged rim and carinated at the base and three lids in red ware. "

"Megaliths 4 and 5 were terracotta sarcophagi... measuring 1.37 x 0.45 x 0.47 m and 1.12 x 0.45 x 0.50 m, having six legs each. Of these, one sarcophagus yielded two vases in Black-and-Red ware, and a straight-sided beaker type of bowl in Red Ware, and a few splinters of calcified bones. "

"Megaliths 6 and 7 were urn-burials, placed side by side. The urns yielded a few calcined bones. The urns with globular body, round base and slightly everted rim, are in red-slipped ware, decorated with concentric bands."

There were two attempts to observe anthropological features on this collection. The first study was by Rao (1984). Subsequently he published his inferences on the apparently pathological modifications of the pitted texture of the cortical region of one of the skulls at Megalith II (Rao *et al.* 1996). These reports include neither mensural data for the human remains nor sufficient morphological descriptions, although calotte No.3 is noted as dolichocranic. The present author includes human remains from Agrilpalli in their list of hitherto undescribed or incompletely described Iron Age skeletal series. Rao and his associates (1996) focussed upon the degree of preservation of the Agripalli human remains with incidental attention to anthroposcopic variables. The cists at this megalithic site indicate the practice of secondary burial, commingling of individuals and pot burial containing ashes, fragmentary bones and teeth. Subrahmanyam (1987) notes the presence of some legged sarcophagi and urns in the vicinity. Anthropological importance of the Agripalli collection, the author of this chapter has undertaken a detailed study of the available human remains. He had the opportunity to visit the A.P. State Department of Archaeology and Museums in 1986 and 1998, where he was consulted concerning two specimens recovered from the site. Rao and his associates (1996) observed both specimens previously. The skeletal inventory available for inspection includes: specimen I: skull without mandible, specimen III: skull without mandible, and specimen IV: skull (fragmentary), few long bone and dental chips.

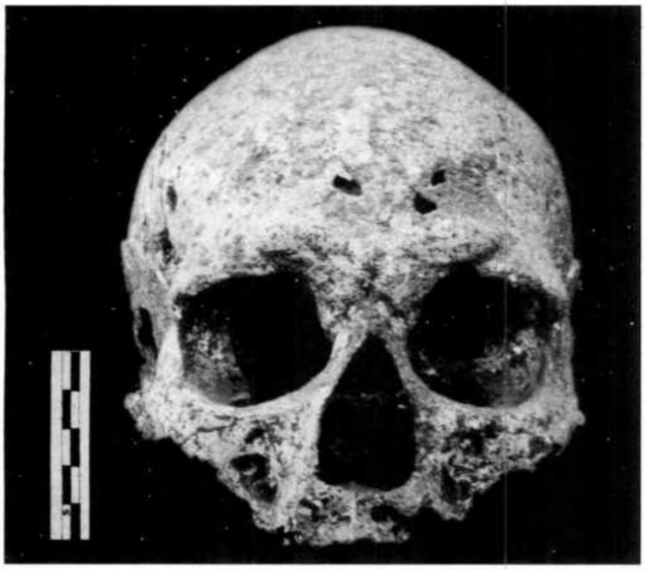

Fig. 5: Agripalli: Skull I, frontal aspect

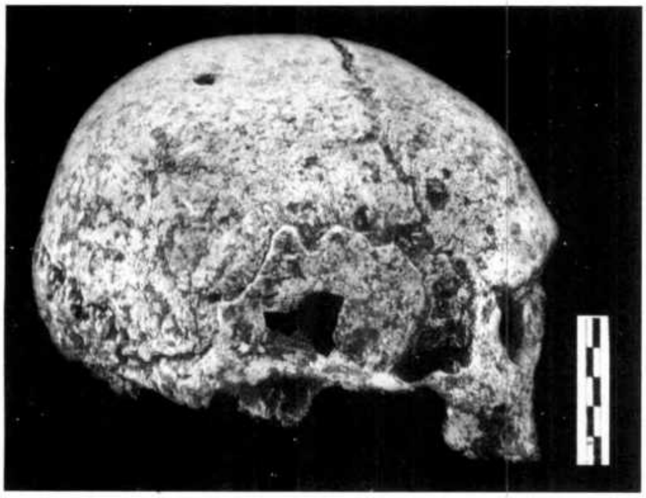

Fig. 6: Agripalli: Skull I, right lateral aspect

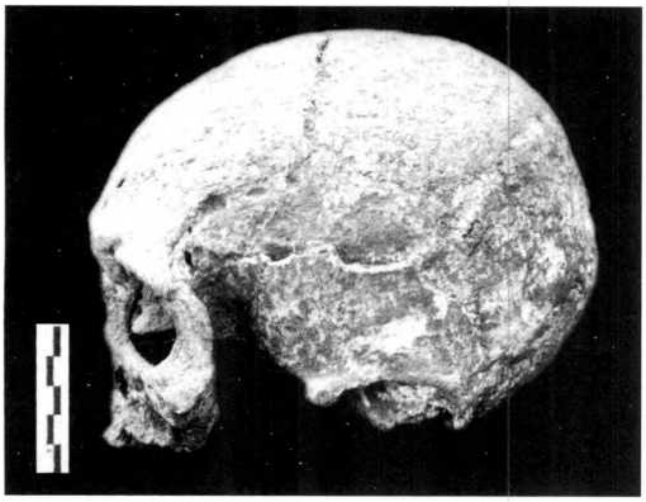

Fig. 7: Agripalli: Skull I, left lateral aspect

Meg II: Skull I

The specimen Meg II-Skull No. 1 is one of the best preserved crania of the entire Iron Age Megalithic series from Andhra Pradesh. However, its mandible was not available for inspection. In *norma frontalis* the cranium is almost complete (Fig. 5). However, the ethmoid and other elements of the nasal choncae are broken. Nasal bones are preserved and the margins of nasal aperture are undamaged. The right maxilla shows pitting just inferior to the infra-orbital foramen. The maxillary alveoli are devoid of teeth, and the 14 associated teeth appear to have been lost post-mortem. The right zygomatic arch is complete, but the left arch is fragmentary. Viewing the cranium in *norma lateralis* (Fig. 6 and 7), the specimen appears to be complete except for damage to the squamous and petrous region of the right temporal bone; the left temporal bone is complete. The occipital bone inferior to the nuchal crest is intact. In basal perspective some damage is observed on the occipital bone (Fig. 8 and 9). The palatine bones are incomplete.

In *norma verticalis* perspective (Fig. 10) the skull appears to be almost complete. The cranial index (75.82) falls at the lower end of this category. The vault appears elongated and rhomboid in shape. The frontal bone is slightly arched and not vertical as is observed with other specimens in the AP series. The greatest cranial breadth is across the parietal eminence. The vault is moderately elevated with indicial values of orthocrany of basion-bregma height/glabella-opisthocranium length and metriocrany of basion-bregma height/bieuryonic breadth (72.52 and 95.65, respectively). The curvature of the vault is uniformly rounded, landmarks of vertex and bregma are close together and yield similar cranial height values. The foramen magnum is narrow, with an estimated index value of 64.86. The external occipital protuberance is well developed.

The upper face is short or euryenic (48.15) and falls near the mesenic range of indices. Post-mortem damage to the alveolar bone, however, compromises this value. Supra-orbital ridges are well developed and show a projecting glabella. Supra orbital foramina are incomplete, and notched. The nasion is markedly depressed. The nasal index is 50.94, a value bordering mesorhinic and chamaerhinic categories. The inter-orbital breadth is less. The rectangular orbits exhibit slight bilateral

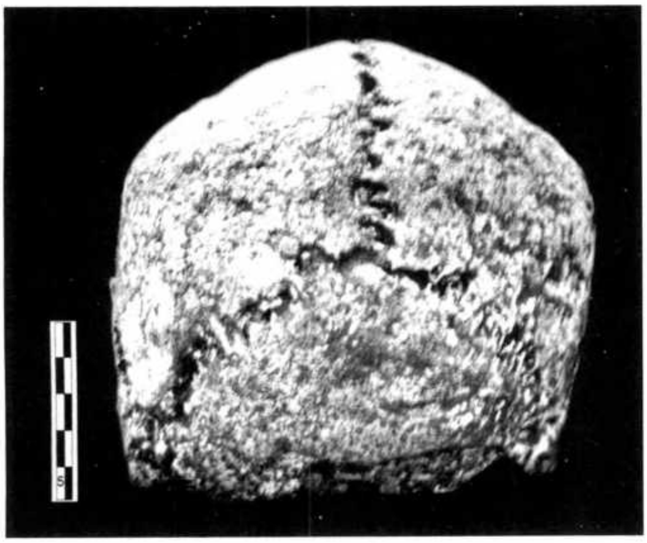

Fig. 8: Agripalli: Skull I, occipital aspect

asymmetry when comparing hypsiconchic right orbit (87.18) with the mesoconchic left orbit (84.62). The zygomatic region is moderately developed. The face, nose and the alveolar region is straight having the angular measurements falling in orthognathus category. The palate is mesostaphylinic (84.09), and orthostaphylinic (32.43,). Glenoid cavities are deep. The estimate of cranial capacity based on basion-bregma height is 1406.47 cc. The craniometric data are listed in Table 2.

The individual is a middle-aged adult around 35-40 years at the time of death. This assessment is based upon obliteration of the cranial sutures. In the absence of pelvic elements, sex determination is based upon the degree of muscular/skeletal robusticity of certain cranial features. Following the scoring system suggested in *"Standards"* (Buikstra and Ubelaker 1994) the specimen is graded as follows: the mastoids: grade 3; supra-orbital ridges: grade 4; glabella: grade 4; and occipital crest: grade 3. Further by judging the robusticity of parietal tubera and temporal lines the sex of the individual is determined as male. The skull is important in palaeopathological perspective, there is erosion of preserved bones of the cranial vault (Fig. 11).

In the course of morphological analyses of these bones, Rao (1984) recognized that it was the skull of an older male with pitted texture of the cortical area. They noted three 'holes' in the glabellar region. Further Rao and his associates (Rao *et al.* 1996) have raised the question that these apparent lesions were due to *treponematosis.* Their diagnosis adds to the venerable debate over the presence of syphilis among the Native Americas prior to initial contact with Europeans in 1492 A.D. Or, could the unusual texture of the bone be a consequence of erosive agents in the burial deposit?

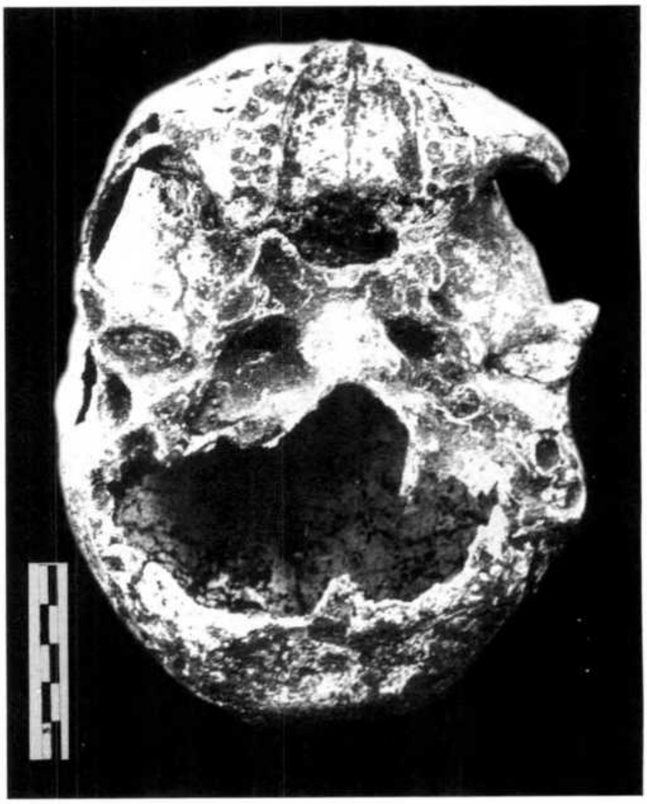

Fig. 9: Agripalli: Skull I, basalar aspect

There is a controversy regarding the antiquity of treponematosis infections. Three hypotheses have been forwarded to explain probable origin of this infection. According to the Columbian hypothesis, it originated in the Americas and spread over to Old World by the Columbian crew in 1493 A.D. Another hypothesis states that it was present in pre-Columbian Europe, prior to the discovery of America, but it was misdiagnosed as leprosy. According to the Unitarian hypothesis, it was present in both the New World and Old World and evolved with the human population (cited in Vasulu 1994).

Treponematosis is an infectious disease in man, caused by a microscopic parasite, *treponeme*. There are four clinical syndromes: venereal syphilis, non-venereal syphilis, yaws and pinta. Venereal syphilis is propagated by sexual contacts between adults and is sporadic. Non-venereal syphilis is caused by causal and non-sexual contacts, and since transmission of non-venereal syphilis occurs widely it is said to be endemic (Hudson 1965). The basic pathological changes, both gross and microscopic of the infectious

Table 2: Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A) Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Max. cranial length (1)	182	180	181	187	185	153	186	179	-	171
Glabella inion length (2)	178	175	-	-	-	-	-	-	-	-
Nasion inion length (2a)	165	165	-	-	-	-	-	-	-	-
Glabella lambda length (3)	176	173	-	-	-	-	-	-	-	-
Nasion basion length (5)	94	-	-	-	-	-	-	-	-	-
Nasion opisthion length (5-1)	130	-	-	-	-	-	-	-	-	-
Opisthion basion length (7)	(37)	-	-	-	-	-	-	-	-	-
Max. cranial breadth (8)	138	136	135	130	132	130	133	143	127	152
Min. frontal breadth (9)	95	-	99	99	100	90.5	94	94	-	103
Max. frontal breadth (10)	118	-	-	111	123	110	111	120	-	129
Bi-auricular breadth (11)	118	109	-	-	-	-	118	-	-	-
Greatest occipital breadth (12)	115	114	-	-	-	-	-	-	-	-
Bi-mastoid breadth (13)	116	(100)	-	-	-	-	-	-	-	-
Breadth of foramen magnum (16)	(24)	-	-	-	-	-	-	-	-	-
Minimum breadth of skull (14)	105	-	-	-	-	-	-	-	-	-
Basion-bregma height (17)	132	-	-	115	-	-	-	136.5	-	-
Basion vertex height, total height of skull (17-2)	135	-	-	-	-	-	-	-	-	-
Auriculo bregmatic height (20)	124	(112)	-	-	-	-	-	-	-	-
Auriculo-bregma length	128 (LS)	122 (RS)	-	-	-	-	-	-	-	-
Calvarial height (22)	104	(96)	-	-	-	-	-	-	-	-
Porion (auriculo) vertex height (21)	125	(114)	-	-	-	-	-	-	-	-
Lambda calvarial height (22b)	73	(25)	-	-	-	-	-	-	-	-
Frontal perpendicular height	29	(35)	-	-	-	-	-	-	-	-
Max. cranial length (1)	182	180	181	187	185	153	186	179	-	171
Glabella inion length (2)	178	175	-	-	-	-	-	-	-	-
Nasion inion length (2a)	165	165	-	-	-	-	-	-	-	-
Glabella lambda length (3)	176	173	-	-	-	-	-	-	-	-
Nasion basion length (5)	94	-	-	-	-	-	-	-	-	-
Nasion opisthion length (5-1)	130	-	-	-	-	-	-	-	-	-
Opisthion basion length (7)	(37)	-	-	-	-	-	-	-	-	-
Max. cranial breadth (8)	138	136	135	130	132	130	133	143	127	152
Min. frontal breadth (9)	95	-	99	99	100	90.5	94	94	-	103

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A) Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Max. frontal breadth (10)	118	-	-	111	123	110	111	120	-	129
Bi-auricular breadth (11)	118	109	-	-	-	-	118	-	-	-
Greatest occipital breadth (12)	115	114	-	-	-	-	-	-	-	-
Bi-mastoid breadth (13)	116	(100)	-	-	-	-	-	-	-	-
Breadth of foramen magnum (16)	(24)	-	-	-	-	-	-	-	-	-
Minimum breadth of skull (14)	105	-	-	-	-	-	-	-	-	-
Basion-bregma height (17)	132	-	-	115	-	-	-	136.5	-	-
Basion vertex height, total height of skull (17-2)	135	-	-	-	-	-	-	-	-	-
Auriculo bregmatic height (20)	124	(112)	-	-	-	-	-	-	-	-
Auriculo-bregma length	128 (LS)	122 (RS)	-	-	-	-	-	-	-	-
Calvarial height (22)	104	(96)	-	-	-	-	-	-	-	-
Porion (auriculo) vertex height (21)	125	(114)	-	-	-	-	-	-	-	-
Lambda calvarial height (22b)	73	(25)	-	-	-	-	-	-	-	-
Frontal perpendicular height	29	(35)	-	-	-	-	-	-	-	-
Parietal perpendicular height	30	(20)	-	-	-	-	-	-	-	-
Horizontal circumference of skull (23)	520	(515)	525	505	-	453	507	502	-	-
Transverse arc (24b)	312	318	-	-	-	293	293	-	-	-
Longitudinal arc (25)	(377)	374	-	-	-	-	-	-	-	-
Frontal arc (26)	135	134	132	123	132	110	132	117	-	-
Parietal arc (27)	127	132	137	125	142	118	124	130	133	140
Occipital arc (28)	(115)	108	-	125	-	-	-	-	-	-
Frontal chord (29)	116	109	112	106	117	94	116	111	-	-
Parietal chord (30)	114	119	122	116	120	103	-	109	110	113
Occipital chord (31)	(92)	(88)	-	-	-	-	-	-	-	-
Facial length (40)	82 ?	-	-	-	-	-	-	-	-	-
Lower facial length, inferior facial depth (42)	63 ?	-	-	-	-	-	-	-	-	-
Outer bi-orbital breadth, upper facial breadth (43)	107	-	-	101	102.5	83	-	-	-	-
Inner bi-orbital breadth (43-1)	100	-	-	-	-	-	101	101	-	-
Bi-orbital breadth (44)	99	-	-	-	-	-	-	-	-	-

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A) Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Bi-zygomatic breadth (45)	(135)	-	-	121	128	89	118	126	-	-
Breadth of upper jaw (46)	102	-	-	-	74	-	-	-	-	-
Nasion menton height (47)	-	-	-	109	115	74	103	105	-	-
Upper facial height (48)	65	-	-	70	67.5	45	67	-	-	-
Sub-nasal height (48-1)	-	-	-	-	19.5	10		14.5	-	-
Breadth of nasal root (49)	13	-	-	-	-	-	-	-	-	-
Anterior inter-orbital breadth (50)	23	-	-	29	26.5	-	-	-	-	-
Orbital breadth (51)	39 (RS) 39 (RS)	-	-	39 (RS) 39 (LS)	- 41 (LS)	-	-	-	-	-
Orbital height (52)	34 (RS) 33 (RS)	-	-	36 (RS) 37 (LS)	- 32 (LS)	-	- 30 (LS)	32 (RS) 32.5 (LS)	-	-
Nasal breadth (54)	27	-	-	26.5	28	22	35	30	-	-
Nasal height (55)	53	-	-	50	48	35	53	51.5	-	-
Length of Nasal bones (56)	(14)	-	-	-	-	-	-	-	-	-
Maxillo-alveolar length, length of upper jaw (60)	(43)	-	-	-	-	-	-	-	-	-
Maxillo-alveolar breadth, breadth of upper jaw (61)	60	-	-	-	49	-	68	-	-	-
Sub-nasal height (48-1)	(17)	-	-	-	-	-	17	-	-	-
Palatal length (62)	(44)	-	-	-	-	-	-	60	-	-
Palatal breadth (63)	37	-	-	-	-	-	47	61	-	-
Palatal height (depth) (64)	12	-	-	-	14	-	-	16	-	-
External palatal arc (80)	114	-	-	-	-	-	-	-	-	-
Bi-condylar breadth (65)	-	-	-	116	-	83	-	-	-	-
Bi-coronoid breadth (65-1)	-	-	-	-	-	-	115	-	-	-
Bi-gonial breadth (66)	-	-	-	96	-	67	-	-	-	-
Bi-mental breadth, anterior breadth (67)	-	-	-	48	45	37	46	49	-	-
Length of lower jaw (68)	-	-	86 (RS)	80	87	58	84	80 (RS)	-	-
Condylo-symphyseal length (68-1)	-	-	101 (LS)	73	-	70	97	-	-	-
Chin height, symphyseal height (69)	-	-	25	24	32	22	31	25	-	-
Corpus height at M1 (69-1)	-	-	25 (LS)	26 (RS) 19 (LS)	32 (RS) 32 (LS)	18 (RS) 18 (LS)	29 (RS) 31 (LS)	23 (RS) 24 (LS)	-	-

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A) Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Corpus height at M1 (69-1)	-	-	25 (LS)	26 (RS) 19 (LS)	32 (RS) 32 (LS)	18 (RS) 18 (LS)	29 (RS) 31 (LS)	23 (RS) 24 (LS)	-	-
Condylar height, height of ascending ramus (70),	-	-	67 (RS) -	-	- 61 (LS)	40 (RS) 41 (LS)	53 (RS) 59 (LS)	-	-	-
Height of coronoid (70-1)	-	-	-	-	-	-	-	-	-	-
Ascending ramus minimum breadth (71)	-	-	32 (RS) -	-	- 29 (LS)	26 (RS) 26 (LS)	31 (RS) 31 (LS)	31 (RS) -	-	-
Ascending ramus maximum breadth (71-1)	-	-	-	-	-	31 (RS) 31 (LS)	42 (RS) 43 (LS)	-	-	-
Molar teeth row length (80-3)	-	-	32 (RS) -	32 (RS) 30 (LS)	29 (RS) 29 (LS)	-	- 32 (LS)	-	-	-
Premolar teeth row length [80-b]	-	-	-	-	-	-	-	-	-	-
Molar-premolar row length	-	-	-	-	41 (RS) 42 (LS)	-	- 44 (LS)	-	-	-
Total profile angle, facial profile angle (72)	88^0	-	-	-	-	-	-	-	-	-
Nasal profile angle (73)	93^0	-	-	-	-	-	-	-	-	-
Alveolar profile angle (74)	90^0	-	-	-	-	-	-	-	-	-
Calvarial base angle (37)	5^0	-	-	-	-	-	-	-	-	-
Glabella-inion angle (32a)	11^0	-	-	-	-	-	-	-	-	-
Nasion-basion angle (33-l)	(15^0)	-	-	-	-	-	-	-	-	-
Lambda-inion angle	102^0	-	-	-	-	-	-	-	-	-
Bregma angle of Schwalbe (32-1)	36^0	-	-	-	-	-	-	-	-	-
Lambda angle of Schwalbe	97^0	-	-	-	-	-	-	-	-	-

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Angles of superior facial triangle		-	-	-	-	-	-	-	-	-
n - ba - pr	8^0									
ba - pr - n	33^0									
pr – n - ba	79^0									
Angles of cranial quadrilateral		-	-	-	-	-	-	-	-	-
l – ba - n	133^0									
ba- n - b	64^0									
n - b - l	96^0									
b – l - ba	67^0									
Mandibular angle, gonial angle (79)	-	-	-	123^0	114^0	145° (RS) 150° (LS)	95 (RS)	-	-	-
Cranial capacity (Lee-Pearson 1901) (38)	1406.47 Euencranic	-	-	-	-	-	-	1454	-	-
Cranial index (I 1)	75.82 Mesocranial	75.55 Mesocranial	74.58	69.51	71.35	84.96	71.50	79.88 Mesocranic	-	-
Length-height cranial index (I 2)	72.52 Orthocranial	-	-	-	-	-	-	76.25	-	88.88 Hyper-brachycranic
Breadth-height cranial index (I 3)	95.65 Metriocranial	-	-	-	-	-	-	95.45	-	-
Auriculo-vertical index (I 4)	76.92 Hypsicranial	62.22 Orthocranial	-	-	-	-	-	-	-	-
Calvarial height-breadth index (I 6)	75.36	70.59	-	-	-	-	-	-	-	-
Hauschild's circumference height index (I 9)	25.38	-	-	-	-	-	-	-	-	-
Sagittal arc index (I 10)	32 89	29.95	-	-	-	-	-	-	-	-

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59. Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Transverse frontal index (I 12)	80.51	-	-	89.18	81.30	69.61 Mesosemic	70.67	78.33	-	79.84
Frontal index (I 13)	68.84	-	66.86 Mesosemic	85.38	75.75	-	-	65.73	-	67.76
Sagittal frontal index (I 22)	85.93	81.34	-	-	-	-	-	-	-	-
Sagittal parietal index (I 24)	89.76	90.15	-	-	-	-	-	-	-	-
Sagittal occipital index (I 25)	80.00	-	-	-	-	-	-	-	-	-
Foramen magnum index (I 33)	64.86 Narrow	-	-	-	-	-	-	-	-	-
Skull modulus (I 37)	150.67	-	-	-	-	-	-	152.83	-	-
Total facial index	-	-	-	-	89.84	83.14	77.44	83.33	-	-
Kollman`s upper facial index (I 39)	48.15 Euryen	-	-	-	52.73 Mesenic	50.56 Mesenic	56.77 Leptinic	50.79 Mesenic	-	-
Jugo-malar index (I 41)	75.56	-	-	-	-	-	-	-	-	-
Orbital index (I 42)	-	87.18 Mesoconch	84.62 Mesoconch	92.30 (RS) 94.87 (LS)	78.04 Mesochonic	-	-	86.48 (RS) 85.33 (LS)	-	-
Inter-orbital index (I 46a)	23.13	-	-	28.71	25.85	-	-	28.71	-	-
Nasal index (I 48)	50.94 Mesorhinae	-	-	53.00	58.23	62.85	56.60	-	-	-
Maxillo (palato)-alveolar index (I 54)	139.53 Brachyuranic	-	-	-	-	-	-	-	-	-
Palatal index (I 58)	84.09 Mesostaphylin	-	-	-	-	-	-	-	-	-
Alveolar index, gnathic index (I 60)	87.23	-	-	-	-	-	-	93.39	-	-
Longitudinal cranio-facial index (I 69)	45.05	-	-	-	-	-	-	55.30	-	-
Vertical cranio-facial index (I 70)	49.24	-	-	-	-	-	-	-	-	-

Table 2. Craniometric data

	Agripalli	Agripalli	Kadampur	Tenner	Tenner	Tenner	Tenner	Veerabyini Kunta	Veerabyini Kunta	Veerabyini Kunta
Measurement / Index	Megalith II: Skull No. I	Megalith II: Skull No. III	Sp. 1/4 (A Megalith IV	Sp. 1/70 A	Sp. 3/70	Sp. 4/70	Sp. 5/70	Sp. 1/59, Megalith I	Sp. 3/59, Megalith I	Sp. 5/59, Megalith I
Sex	Male	Male	?	Female	Male	?	Male	Male	Female ?	Female
Age	35-40 years	35-40 years	18-22 years	Adult	More than 25 years	5-6 years	30-40 years	More than 30 years	Young adult	More than 35 years
Transverse cranio-facial index (I 71)	97.83	-	-	-	-	-	-	-	-	-
Fronto-orbital index (I 72)	88.79	-	-	-	-	-	-	-	-	-
Jugo-frontal index (I 73)	70.37	-	-	95.86	78.12	93.25	94.06	74.60	-	-
Palatal height index (I 59)	32.43 Orthostaphylin	-	-	-	-	-	-	-	-	-

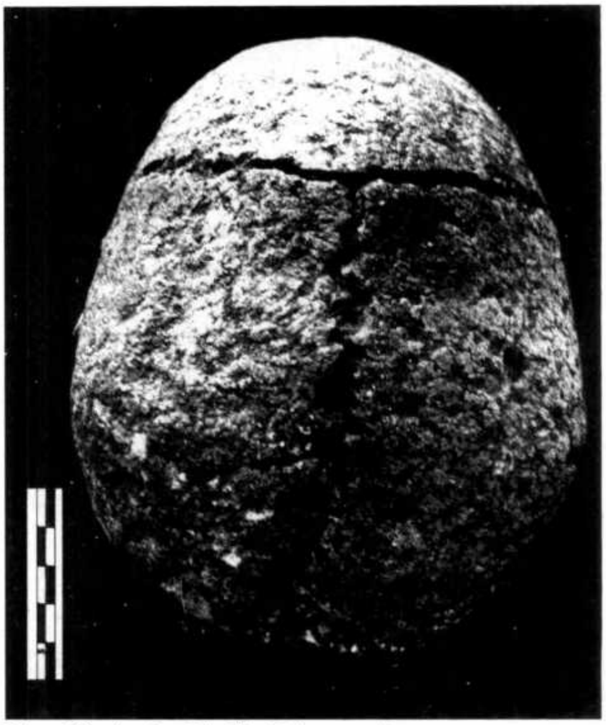

Fig. 10: Agripalli: Skull I, superior aspect

diseases of pinta, yaws, endemic syphilis and venereal syphilis are identical. Differences between them are purely quantitative and of degree, and are not qualitative. Pinta is slightly different because the pathological changes are limited only to skin, and therefore not manifested in skeletal material.

The bone changes of yaws, endemic syphilis and venereal syphilis are induced by an inflammatory reaction specific to *Treponema* (Canci *et al*. 1994). This reaction, which results in gross bone destruction, is called gumma. In yaws, the tibia is the most commonly involved bone, and only to a lesser extent are the other bones of the skeleton involved. The skull is infrequently involved. In syphilis, multiple bones are involved, but tibia is again the most frequently affected bone. Besides tibia, in endemic syphilis bones like clavicle, radius, carpals and metacarpals are involved, while in venereal syphilis, the plate bones of the cranial vault, nasal area, and mainly frontal and parietals of neurocranium exhibit a characteristic 'worm eaten' appearance (Roberts and Manchester 1995).

The outer table of the cranium of the specimen undoubtedly has a 'worm eaten' appearance. However, there are no bone modifications in the nasal or palate which are more vulnerable regions to the pathogen. Moreover, the inner table is to a large extent undamaged which makes the earlier diagnosis doubtful. The pits are superficial, not penetrating to the inner table. For example, there are depressions almost 3 mm deep on right parietal, and on right side of frontal (near coronale). In these cases, the inner table is unaffected, but the bone looks thin. For infection of this magnitude one would imagine holes for draining out impurities, rather than superficial pits. There are no long bones available for inspection.

Though the accuracy of the diagnosis has been questioned by others as well (Jackson and Armelagos 1998), further comments are necessary. Are these bone changes taphonomic in origin? This theory is doubtful as well. The cist containing the skull (skeleton) in question also yielded remains of another individual (Skull III); this skull lay approximately 10 cm away and did not show any pathological or pseudopathological changes. While confirmative statement is not possible the 'lesions' may indicate other pathological possibilities, like *porotic hyperostosis* related to iron deficiency and anemias, rickets or *osteomalacia.*

Certainly, the chronological date of the specimen cannot be used to defy the diagnosis. Till date, there are at least three possible cases of treponemal infections identified from the archaeological human skeletal record obtained from India. The evidence comes from three sites, Nevasa, Kaothe, and Jotsoma, two of which belonging to the Chalcolithic levels give even earlier dates (Mushrif and Walimbe 2006, Mushrif *et al.* 2008).

Meg II: Skull III

The individual is represented by incompletely preserved cranial cap, but the mandible is not present.

From a *norma frontalis* perspective (Fig. 12) most of the frontal bone is preserved as is the glabella. The remainder of the supra-orbital region is lost as are facial bones. In the lateral aspect (Fig. 13, and Fig. 14, see on cover 2) a total loss of sphenoid and most of the temporal can be noted. The left mastoid is damaged but the external auditory meatus is intact. For the right side, in addition to the loss of the two bones mentioned above, the frontal bone also suffered as a part of the coronal suture and part of the bone anterior to this suture is broken. The occipital is nearly complete, even in the basal perspective, except for the damage that has occurred near the foramen magnum (Fig. 15, see on cover 2). The centrum is missing. Parietals are present (Fig. 16, see on cover 2), the left one is complete, and the right one is laterally broken.

The specimen is moderately built. Temporal lines are moderate, but the mastoids are delicate; the judgement is likely to have been influenced because of the damage to the tip of the process. The occipital crest is quite robust. The cranial index is 75.55, the value falls in mesocrany category. Craniometric measurements are given in Table 2.

The specimen is moderately built. The overall morphology of the bones suggest a middle-aged adult status and age around 30-35 years at the time of death. No precise comment can be forwarded for sex determination. The right supra orbital region is less prominent (in comparison with Skull I), rated as grade 3. Mastoid expression is of grade 2, and occipital crest as grade 4. More likely the specimen looks like male, slightly less robust than the Skull I.

No unusual pathological anomalies/ lesions are seen on the specimen.

Skull IV

Skull IV is very fragmentary with a thin cover of bones. Neurocranial fragments are all medium- or

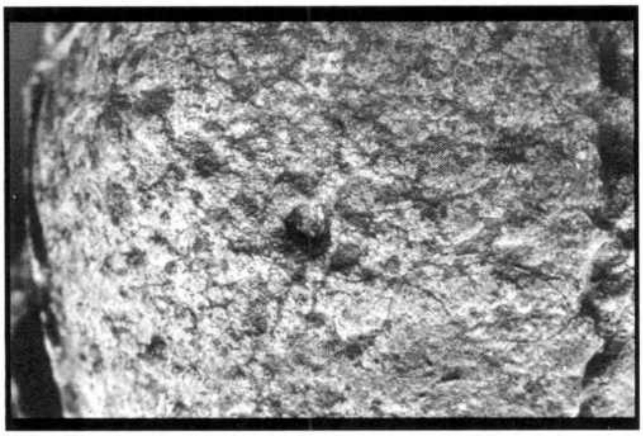

Fig. 11: Agripalli: Skull I, close-up of bone changes on cranium

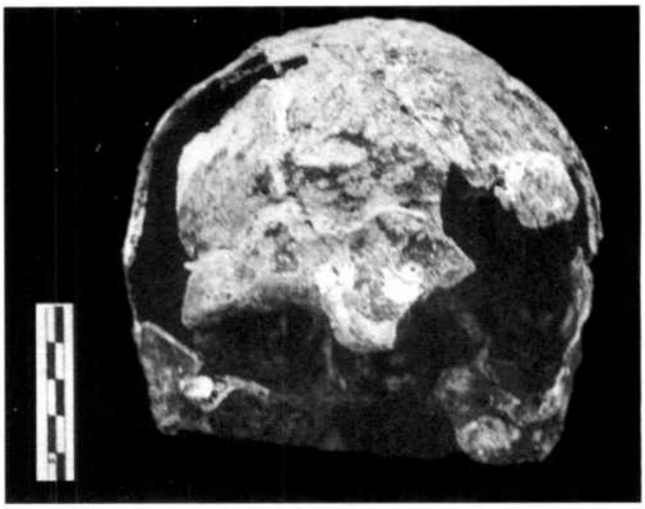

Fig. 12: Agripalli: Skull III, frontal aspect

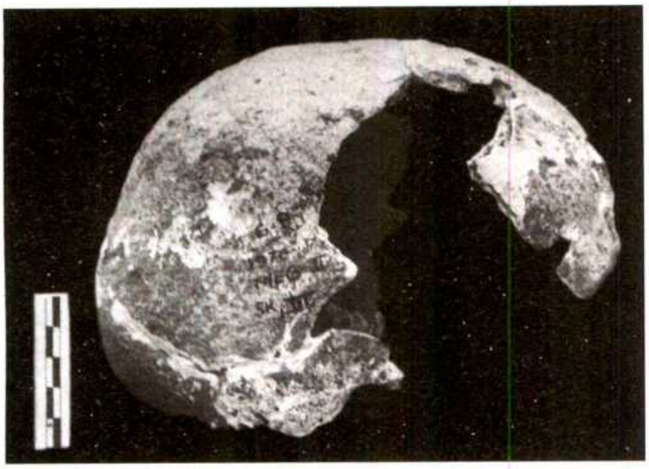
Fig. 13: Agripalli: Skull III, right lateral aspect

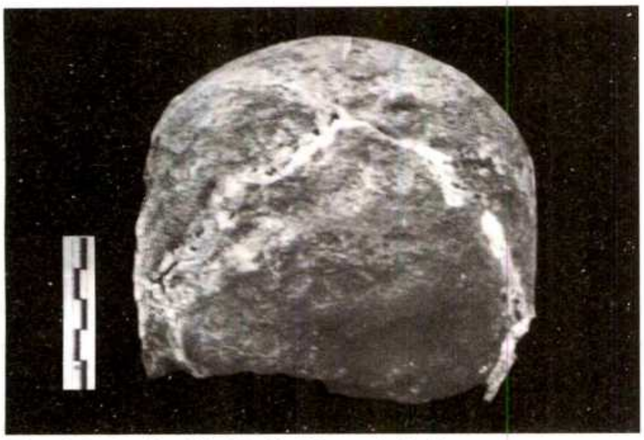
Fig. 14: Agripalli: Skull III, occipital aspect

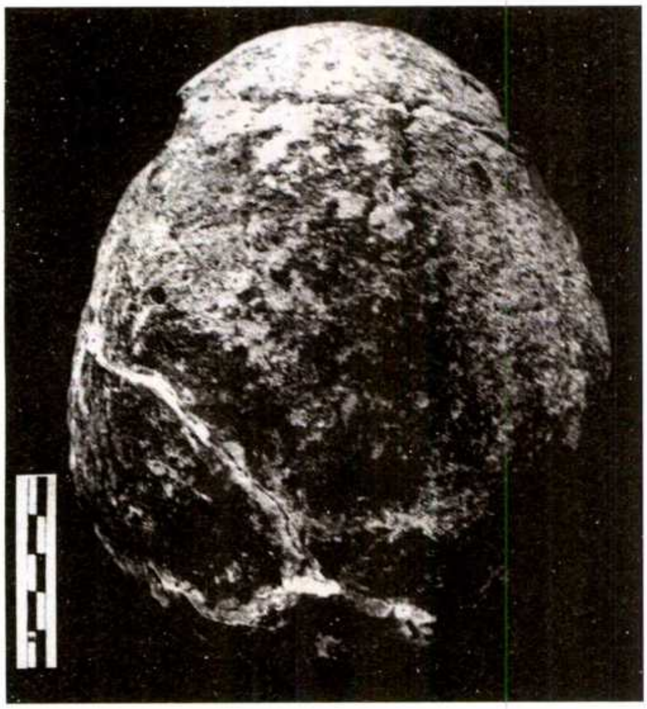
Fig. 15: Agripalli: Skull III, superior aspect

small-sized. Identifiable fragments include the following:- superior margin of left auditory meatus, with part of squamous portion; right auditory meatus with superior squamous portion; left frontal with part of temporal line and left orbit superior margin; right and left parietal fragments with squamous sutural edges. Besides, there are about 30 small-sized chips of neurocranium which are unidentifiable. The earlier investigation (Rao 1984) reports disintegrated long bones and a few loose and disintegrated teeth 'such as premolar, molar and incisor'. Apart from these bones, apparently there were also small burnt and charred bones in the cist. These elements were not available to the present author for inspection, except one tooth, a right (?) maxillary premolar. The tooth is damaged in the labial region and no measurements are possible. Photographic documentation is not done for this specimen. The individual appear to be a middle-aged adult, around 40 years. Sex determination is not possible owing to the absence of sexually diagnostic parts.

*Kadambapur, Tenner and Veerabyina Kunta***

Kadambapur

Over 500 graves were documented in Karimnagar District of Andhra Pradesh. Of the five skeletons excavated in 1975-1976 (IAR 1976-1977: 5), four are pit burials and one lies in a cist. The latter yielded two skulls and commingled postcranial bones from a secondary burial practice plus a relatively complete skeleton except (antemortem) amputed leg (right or left bones?). Subrahmanyam (1987: 15) writes that leg amputation was "a practice which was in vogue (in) the Jorwe culture of Maharashtra, as documented at Daimabad, Chandoli and Inamgaon". He sets the date of the Kadambupur skeleton at the third century B.C. on the basis of a design painted on a potsherd associated with the burial. The human remains from Kadambapur are described below in the order of their examination by the American team in Hyderabad in 1988 (Table 4; Figs. 17-20).

Specimen No. 1/4 (A), Megalith IV

The dolichocranic and ovoid cranial vault is preserved and partially restored. The frontal bone has retained its glabellar area and bones of the nasal root. Nasion depression is absent. The parietal bones show loss of their lateral margins of contact with

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** This part is contributed by P. Caldwell-Ott and K.A.R. Kennedy

Table 3: Osteometric data

Measurement	Tenner 1/70 B RS	Tenner 1/70 B LS	Tenner 3/70 RS	Tenner 3/70 LS	Tenner 4/70 RS	Tenner 4/70 LS	Tenner 5/70 RS	Tenner 5/70 LS
Clavicle								
Maximum length	108	-	-	-	-	-	130	-
Vertical diameter in middle	11	-	-	-	-	-	12	-
Sagittal diameter in middle	10	-	-	-	-	-	10	-
Girth in middle	34	-	-	-	-	-	39	-
Caliber index, robustness index	31.48	-	-	-	-	-	30.00	-
Clavicular middle index	90.90	-	-	-	-	-	83.33	-
Cross section index	110.00	-	-	-	-	-	120.00	-
Claviculo-humeral index	38.98	-	-	-	-	-	39.27	-
Humerus								
Maximum length	277	281	-	-	-	-	248	331
Maximum diameter in middle	19	20	-	21	-	-	-	-
Minimum diameter in middle	18	17	-	20	-	-	22	19
Girth in middle of shaft	58	56	-	65	-	-	19	20
Minimum circumference of shaft	-	-	-	63	-	-	60	59
Cross section index of shaft	94.73	85.00	-	95.23	-	-	-	-
Robusticity index, caliber index	20.90	19.92	-	-	-	-	-	-
Claviculo-humeral index	38.98	-	-	-	-	-	39.27	-
Radius								
Maximum length	176	159	-	-	-	-	274	-
Least girth of shaft	-	45	49	48	-	-	45	-
Transverse diameter of shaft	13	12	13	12	-	-	15	-
Sagittal diameter of shaft	16	15	17	16	-	-	-	-
Caput diameter anterior-posterior	-	-	-	-	-	-	21	-
Caput diameter lateral	-	-	-	-	-	-	23	-
Caput circumference	-	-	-	-	-	-	71	-
Mid-shaft circumference	48	46	-	-	-	-	45	-
Caliber index, robusticity index	-	28.30	-	-	-	-	16.42	-
Cross section index of shaft	-	125.00	76.47	75.00	-	-	-	-
Radio-humeral index	63.53	56.58	-	-	-	-	110.48	-

Table 3: Osteometric data (contd..)

Measurement	Tenner 1/70 B RS	Tenner 1/70 B LS	Tenner 3/70 RS	Tenner 3/70 LS	Tenner 4/70 RS	Tenner 4/70 LS	Tenner 5/70 RS	Tenner 5/70 LS
Ulna								
Maximum length	203	156	-	-	-	-	-	-
Minimum girth of ulna	37	-	39	-	-	-	-	40
Dorso-volar diameter	12	11	11	-	-	-	-	12
Transverse diameter	16	17	12	-	-	-	-	14
Mid-shaft circumference	48	47	47	-	-	-	-	43
Caliber index, robusticity index	18.22	-	-	-	-	-	-	-
Cross section index of shaft	75.00	64.70	91.66	-	-	-	-	-
Platoleni index	-	-	85.71	-	-	-	-	85.71
Radio-ulnar index	86.69	55.51	-	-	-	-	-	-
Ulno-humeral index	73.28	55.51	-	-	-	-	-	-
Femur								
Maximum length	283	328	-	-	220	219	402	-
Sagittal diameter at mid-shaft	26	26	-	-	13	13	27	-
Transverse diameter at mid-shaft	27	26	-	-	13	14	27	-
Girth at mid-shaft	85	84	87	90	44	43	93	-
Upper transverse diameter of shaft, transverse diameter at subtrochanterion	-	-	34	31	19	20	30	-
Upper sagittal diameter of shaft, anterio-posterior diameter at subtrochanterion	-	-	25	26	18	18	31	-
Least lower sagittal diameter of shaft	-	-	29.5	31	-	-	-	-
Lower transverse diameter of shaft	-	-	27	27	-	-	-	-
Caput anterior-posterior diameter	-	-	-	49	-	-	-	-
Caput transverse diameter	-	-	45	44	-	-	-	-
Collo-diaphyseal angle	-	-	131°	-	-	-	-	-
Length-thickness index	30.03	25.60	-	-	-	-	23.13	-
Robusticity index	18.72	15.85	-	-	-	-	13.43	-
Pilastric index	96.29 Weak	100.00 weak	-	-	100.00	92.85	100.00	-
Platymeric index	-	-	73.52 Hyper platymeric	83.87 Platymeric	94.74 Eurymeric	90.00 Eurymeric	103.33 Stenimeric	-
Popliteal index	-	-	109.25	114.81	-	-	-	-

Table 3: Osteometric data (contd..)

Measurement	Tenner 1/70 B RS	Tenner 1/70 B LS	Tenner 3/70 RS	Tenner 3/70 LS	Tenner 4/70 RS	Tenner 4/70 LS	Tenner 5/70 RS	Tenner 5/70 LS
Tibia								
Total length of tibia, lateral condylar malleolar length	282	271	-	-	-	-	295	266
Anterio-posterior diameter at nutrient foramen	32	30	-	35	-	12	35	-
Medio-lateral diameter at nutrient foramen	18	23	-	24	-	17	22	-
Maximum sagittal diameter at mid-shaft	31	27	-	25	-	-	31	37
Maximum transverse diameter at mid-shaft	17	21	-	23	-	-	22	20
Minimum shaft anterior-posterior diameter	-	-	-	22	-	-	-	-
Minimum shaft lateral diameter	-	-	-	24	-	-	-	-
Girth of shaft	72	73	-	83	-	-	84	91
Minimum girth of shaft	-	-	-	83	-	-	75	72
Platycnemic index	56.25	76.66	-	68.57	-	70.58	70.96	54.05 Platy
Range variation (Martin-Saller 1957)	Platycnemic	Eurycnemic				Eurycnemic		cnemic
Length-thickness index	25.53	26.93	-	-	-	-	-	-
Tibio-femoral index	99.64	82.65	-	-	-	-	-	-
Fibula								
Maximum length of fibula	276	-	-	-	-	-	-	322
Maximum diameter in middle	12	-	16	14.5	-	-	-	14
Minimum diameter in middle	10	-	11.5	11	-	-	-	10
Girth in middle	38	-	46	44	-	-	-	46
Minimum girth of bone	-	-	-	-	-	-	-	43
Cross-section index in middle	83.33	-	71.87	75.86	-	-	-	71.42
Caliber index	13.76	-	-	-	-	-	-	14.28
Tibio-fibular index	102.53	-	-	-	-	-	-	82.60
Fibulo-femoral index	97.52	-	-	-	-	-	-	-
Talus								
Maximum length	-	-	63	-	-	-	-	-
Maximum breadth	-	-	39	-	-	-	-	-
Maximum height	-	-	35	-	-	-	-	-
Trochlea tali length	-	-	40	-	-	-	-	-
Trochlea tali breadth	-	-	30	-	-	-	-	-
Talus length-breadth index	-	-	61.90	-	-	-	-	-
Talus length-height index	-	-	55.55	-	-	-	-	-
Talus trochear length-breadth index	-	-	75.00	-	-	-	-	-
Calcaneus								
Maximum length	-	-	85	-	-	-	-	-
Maximum height	-	-	48	-	-	-	-	-
Calcaneus length-height index	-	-	75.00	-	-	-	-	-

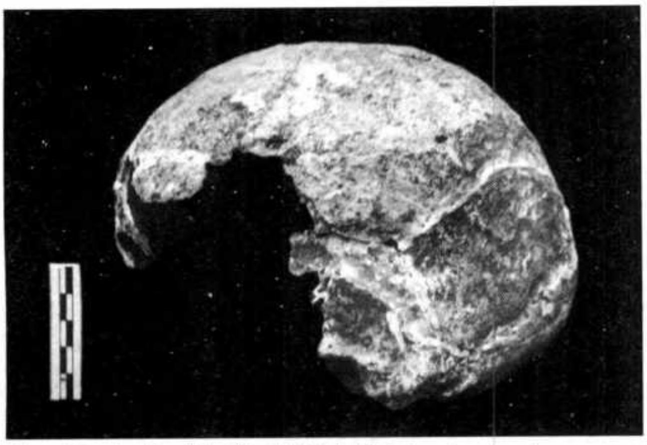

Fig. 16; Agripalli: Skull III, left lateral aspect

the temporal bones. The occipital bone is complete and has a low external occipital protuberance and a moderate-size chignon. Neither facial nor basalar bones are present. Cranial sutures of the vault are patent. The mastoids are small. More prominent features are the large glabella and supramastoid crests with shallow digastric fossae.

The mandible of this cranium is incomplete but better preserved on its left side. The LM1 and LM2 are in their alveoli and only the root sockets for the other permanent teeth are preserved. Pieces of the right side of the mandible are represented by a ramus with the right condyle present. Chin form is median and triangular, but not large. Anterior curvature of the mandible is round and the gonial angle obtuse, features that suggest that this was a young adult female. Only a few measurements of the mandible are possible. If a young adult female the age estimation would fall between 18 to 22 years. Knussmann's (1988) anthropometric codes are in parenthesis in the columns of anthropometic measurements (Table 2).

Specimen No.1 (A), Megalith III

More than one individual is present in a pottery urn of comingled bones. The bones are fragmentary, neither cleaned nor unrestored before the 1988 study. Portions of crania, upper and lower long bones and ribs are identifiable. Pelvic fragments are absent. Several large pieces of adult femora and tibiae are included inside the field container with a paper bag bearing a label of "left femur". There is a partial mandible with a dental eruption pattern that would be characteristic of a child of 4-5 years of age at time of death development. There is an emergence of a lower RI1 and RI2. Deciduous teeth are extremely worn, especially Rdi1. Three isolated deciduous teeth were recovered in the vicinity of the child's skull along with several permanent teeth. None of the deciduous or permanent teeth exhibit caries or other dental pathological conditions.

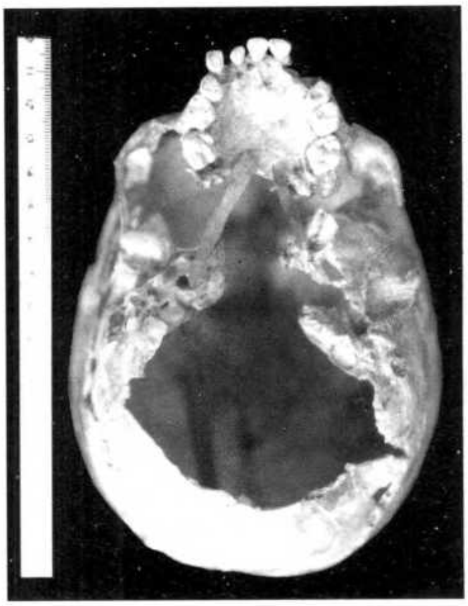

Fig. 17: Kadambapur: No. 1/4B, cranium, basalar aspect

Specimen No. 2/4 (Skull No. 2), Megalith IV

All 36 cranial fragments defy reconstruction of a single skull; hence metrical examination was not undertaken. Identifiable were a right parietal bone with a prominent eminence. A segment of sagittal suture has advanced closure, although the union with the occipital bone has not fused at lambda. The right temporal bone has a thin tympanic plate, short mastoid process with a mound-shaped supramastoid crest. The frontal bone fragment reveals a divided brow ridge, a mere trace of a torus and a flat glabella. It is likely that this individual was a young female.

An incomplete mandible retains a single right first permanent molar (RM1) and two left molars (LM1 and LM2). Lower third molars are absent and the alveolar surfaces for their accommodation indicate that these teeth had not erupted. Dental wear is most pronounced on RLM1 although all three teeth show postmortem chipping and erosion. The alveoli of these molar's roots indicate periodontal disease. Identifiable mandibular fragments include a portion of the right ramus retaining its mandibular notch and a single corpus 42 mm in length and 13 mm thick. The alveolus of the RC marks the most anterior extension of the right molar row.

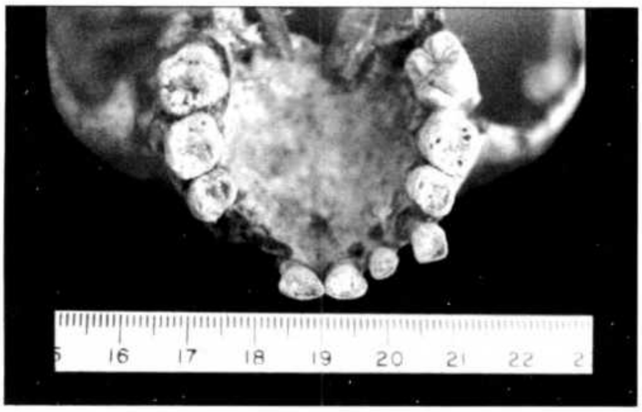

Fig. 18: Kadambapur: No.1/4B, cranium, palatal aspect

Specimen 1/4 (B), Megalith IV

The cranial vault has pronounced inclination of the frontal bone and a large frontal eminence. Parietal bosses are large. The sagittal suture does not assume a straight line between bregma and lambda, but is curved to the left, perhaps a consequence of postmortem distortion. Internally placed wooden struts had been inserted into the vault as measures for preservation. Some 30 small fragments were included in a reconstruction of the specimen prior to 1988; perhaps a measure taken in the field following excavation. There are traces of burnt regions on some fragments which suggest partial cremation prior to burial.

The mandible with this cranium is incomplete but better preserved on its left side. The LM1 and LM2 are in their alveoli and only the root sockets for premolars, canine and incisors are preserved. Pieces of the right side of the mandible are represented by a ramus with its condyle. Chin form is median and triangular but not pronounced. Anterior curvature of the mandible is round and the gonial angle obtuse, features that suggest the individual was a young adult female. Other markers of sex determination are the weakly developed lingual tubercles and slight eversion of the gonium. (Figs. 17-19).

Specimen No. 5/70 A, Megalith IV

The cranium, mandible and teeth suggest that this was a child of 5.5 - 6.5 years of age. A metopic suture is patent. The upper and lower RLM1s are fully erupted. All deciduous teeth are present in their alveoli with the exception of the upper canine and incisors. The maxillary incisors exhibit a moderate degree of shoveling. The mandibular dentition shows a +4 cusp and groove pattern for the two lower permanent molars. There is a moderate degree of wear on the occlusal surfaces of the deciduous teeth.

Specimen No. 1/70A, Megalith IV

The sex of this individual is uncertain, but the age at time of death is more than 30 years. The age determination is based upon the advancing degree of cranial suture closure, particularly of *pars pterica* and *pars media*. However, the dental assessment places this individual within the range of 35-50 years of age.

The form of the cranial vault is hyperdolichocranic and hypermesgasemic with a "divergent" frontal bone. The frontal region is low and vertical with small frontal eminences. Glabella is median and the parietal eminences show a moderate degree of development. The nasal depression is shallow. Parietal bosses are not prominent. Also reduced in relative size are the temporal lines. The occipital bone shows an even pattern of curvature, but damage precludes an assessment of the degree of development of the superior and inferior nuchal crests and the posterior occipital protuberance. There is considerable warping of the left temporal bone. The mastoid processes are short and thick with deep digastric fossae. The vault appears to be metriocranic.

The face is leptoprosopic and leptinic. The nasal form is chamaerrhine with dull inferior marginal sills. The palate is severely distorted, but is deep and elongated. Malars are small and gracile and have deep canine fossae. The mid-facial profile is orthognathic although there is a moderate degree of alveolar prognathism.

There is considerable mandibular remodeling due to antemortem loss of the mandibular molars (Fig. 20). This results in a very obtuse angle of the rami and unevenness in the superior elevation of the corpora. Gonia are slightly everted. Mylohyoid crests are small. There is a prominent bilateral mental eminence. The sigmoid notch has a moderate degree of depth. Some of these variables are found in high frequency in female mandibles among other populations of the world.

Tenner (Tenneru)

Four relatively complete adult skeletons and a child's skull were excavated in 1970 -1971 in Krishna district. They were buried in pits holding sarcophagi. These are primary burials and graves are not lined with stones, a common practice of megalith-builders of Andhra Pradesh and in other Indian states

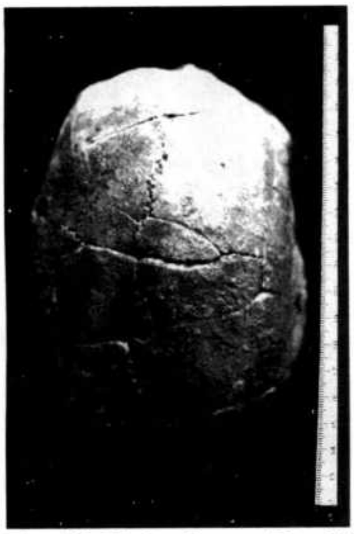

Fig. 19: Kadambapur: No. 1/4B, cranium, superior aspect

Specimen No.1 /70 A: (Fig. 21)
This hyperdolichocranic vault is hypermegasemic with a "divergent" frontal bone and a metopic suture. The forehead is low and vertical and frontal eminences are not pronounced. Nasion depression is shallow. Glabella is moderate in development with a median pattern. Parietal eminences are low as are temporal lines. The occipital bone shows even curvature, but damage precludes an assessment of the superior and inferior nuchal crests. There is considerable warping of the left temporal region. Mastoid processes are short and thick with shallow and wide digastric fossae. The vault is metriocranic. The obelionic depression is low. This cranium and its mandible have morphological features characteristic of an adult female.

There is considerable mandibular remodeling because of the antemortem loss of the lower molars. Pronounced inclination is often assumed to be an indicator or the female sex, but this may occur among males with loss of their back teeth, resulting in a very obtuse angle of the rami as well as changes in the elevation of the corpera. The mental eminence is prominent and bilateral. Gonia are slightly everted. Ptergoid attachments are very pronounced, yet the mylohyoid ridges are low. The sigmoid notch is shallow.

The mandibular dentition shows antemortem loss of the three right permanent molars and early stages of the resorption of their alveoli. Unexpectedly these molars were found as loose teeth within the burial deposit. Also missing are LM1, LM2 and LM3. The right and left permanent premolars show severe buccal wear and are worn smooth with consequent loss of cusps. Only the anterior dentition remains. Upper molar teeth show a moderate degree of wear. The maxillary dentition shows maximum wear of the right permanent lateral incisors, canine, premolars and molars. Central incisors have a pronounced overbite. Neither caries nor dental hypoplasial lines were observed.

Two clavicular fragments are preserved as shafts, missing proximal and distal ends. These bones may not be from the same individual. The right clavicle has a shallow subclavial groove, but the discrepancy of its larger size may be the result of injury or a marker of habitual stress. There are further differences in size of the fragmentary acromial ends. Other fragments of this individual's postcranial bones include fragments or ribs and scapulae, a right humeral head and 18 fragments of including fibulae and radii. Mid-shaft fragments of the upper extremity bones had been glued together prior to the time of the present study.

Of the postcranial bones are the mid-shaft diaphyses of the right and left femora. The linea aspera is higher and more pronounced on the right femur, but smaller and sharp on the left femur. Proximal and distal articulations are present but too severely damaged to provide reconstruction of their maximum lengths. Right and left tibiae are in a similar degree of preservation, but their nutrient foramina are visible and the right femur has retained the joint articulation with the fibula. Tibial tuberosities are not present. A right fibula is preserved in several mid-shaft pieces which, when articulated, form a straight shaft. All of the tarsal bones, matatarsals and phalanges are represented in small fragments which are not sufficiently complete to be measured. Squatting facets are not present.

Specimen No. 1/70 B (Fig. 22)
The sex of this individual is uncertain, but the age is estimated as more than 30 years. Age determination is based upon the advancing degree of cranial suture closure, particularly at *pars pterica* and *pars media.* However, the dental assessment places this individual within the age ranges of 35-50 years at time of death.

The form of the cranial vault is hyperdolichocranic and hypermegasemic with a "divergent-type" frontal bone. The frontal area is low and vertical with small frontal eminences. Glabella is median. Parietal eminences are of a moderate degree

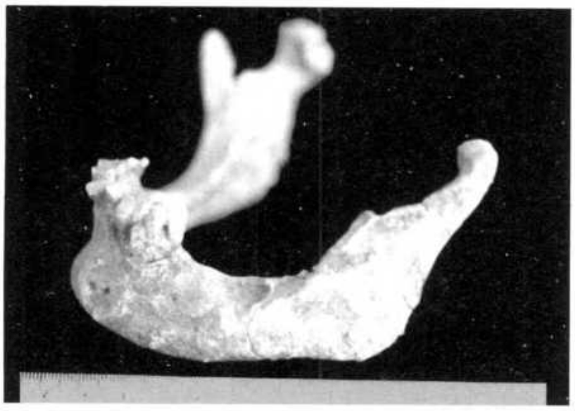

Fig. 20: Kadambapur: No. 1/70A, mandible, left lateral aspect

of development. The nasal depression is shallow. Parietal bosses are not prominent. Also reduced in size are the temporal lines. The occipital bone has even curvature, but damage precludes an assessment of the degree of development of the superior and inferior nuchal crests and the external occipital protuberance. There is considerable warping of the left temporal bone. Mastoid processes are short and thick with shallow and deep digastric fossae. The vault appears to be metriocranic.

The face is leptoprosopic and leptinic. Nasal form is chamaerrhinic with sharp nasal sills. Nasal profile is concave. Orbits are hypsiconchic with dull inferior margins. Alveolar prognathism is pronounced. The palate is severely distorted, but is deep and elongated. Malars are small and gracile with deep canine fossae. The mid-facial profile is orthognathic, although there is slight alveolar prognathism.

There is considerable remodeling of the mandible due to the antemortem loss of the lower molars. This results in a very obtuse angle of the ramus and changes in height elevation of the corpera. Gonia are slightly everted. Mylohyoid crests are small. There is a prominent bilatertal mental eminence. The sigmoid notch is of moderately deep.

Specimen No. 3/70 (Figs. 23-27)

The cranium is relatively well preserved but shows some warping. The vault is dolichocranic and acrocranic. The frontal is high and steeply inclined with moderately pronounced brow ridges and glabella that form a continuous projection above the orbits. This frontal region is hypermegasemic and "divergent". Parietal eminences are moderately prominent. The occipital bone has even curvature and the superior nuchal crest sweeps across this bone without interruption to the external auditory meatus on opposite sides of the cranium. Temporal fullness is low. The mastoid processes are elongated and narrow and the digastic processes are deep. There is a well marked supramastoid crest. All cranial sutures are visible with synostosis most advanced at *pars lambdica*. Closure at this region is well advanced by 24-26 years. Given the overall osseous robusticity of the cranium (with the exception of the even degree of curvature of the occipital bone) this appears to be a male individual of more than 25 years. These estimates are based upon the degree of wear of the right and left maxillary and mandibular permanent third molars and features of the pelvic bones.

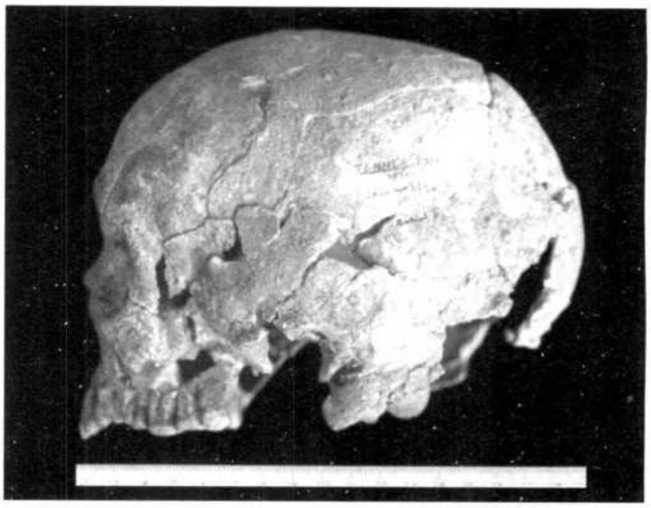

Fig. 21: Tenneru: No. 1/70A, cranium. left lateral aspect

The face is mesoprosopic and mesene. There is a moderate degree of nasal depression and the nasal bones are straight and are hyperchamarrinic. Nasal sills are origmocraspedotic and show a slight degree of guttering. Orbits are mesochonchic and their inferior margins are dull. The orbital shape is rectangular. The malars are robust with prominent zygomatic attachments. There is a moderate degree of alveolar prognathism, but facial projection is flat. The palate is severely distorted and was not reconstructed.

The mandible is well preserved save for the loss of the right condylar process and some warping. Measurements of bicondylar and bigonial diameters are approximate. This is a robust bone with a prominent median mental eminence, everted gonia with robust ptergoid attachments, large mylohyoid ridges and sharp gonial tubercles. The steeply inclined rami are not characteristically a male feature. The grooves posterior to the right and left permanent third molars are very prominent, particularly on the left corpus.

The complete permanent dentition is free of caries, but there is crowding of the upper and lower lateral incisors, which are set forward of their adjacent teeth. The lower incisor is pushed back in an alveolar socket posterior to the other anterior teeth. Wear is pronounced for all of the anterior teeth, the premolars and right and left permanent first molars. Pitting of the occlusal enamel surfaces of the premolars is conspicuous. The permanent third molars of the upper and lower dentitions exhibit minimal wear. The cusp and groove pattern of the RM2 is +4; other teeth have lost their cusps and groove patterns because of severe occlusal wear.

Of the postcranial bones there is a left humeral diaphysis which is straight. The deltoid tuberosity is elevated and extends some 52 mm. The bicipital groove is deep. The diaphysis of a right ulna is uroleneal and straight. The supinator crest is deep and rugose. There is minimal retroversion of the proximal diaphysis and head. Interosseous lines are not sharp. A right ulna is a diaphyseal segment with a portion of the inferior margin of the semilunar notch. The left ulna is fragmentary but the mid-shaft portion is present. The right ulna is uroleneal and straight. The supinator crest shows moderate development and the brachialis attachment is rugose and deep. There is minimal retroversion of the proximal diaphysis and head of the ulna. The interosseous line is smooth. Mid-shaft portions of the right and left radii are present, the left bone having retained a portion of its distal end. The shafts are straight and the distal end shows considerable robusticity. Fragments of the carpal bones and phalanges are present.

Portions of the pelvis include right and left ilia with major preservation of the sciatic notches and the acetabular and iliac crests. These structures are robust and marked by the massiveness and thickness of the iliac crests and arcuate lines. The sciatic notch is deep and narrow, as is most commonly encountered in male individuals. Osteoarthritic lipping is not present on the acetabular margins. Femora are mid-shaft portions and the right femur includes the lesser trochanter and head. There is a caput of the left femur which has been separated from the diaphysial portion. The right femur is hyperplatymeric and has pronounced anterior-posterior curvature of the shaft at its proximal end. Although the pilastric index is "weak", the pilaster itself becomes more prominent at the distal end of the bone with an elevation of 8 mm. The lesser trochanter is large and there is a very prominent cristahypotrochanterica and fossa. Remnants of a greater trochanter are massive. These are anatomical features encountered most often in male individuals, hence a confirmation of the assignment of maleness found in the features of the skull. The left femur has a "medium" pilastric index. The right tibia consists of two articulating mid-shaft pieces; the left tibia is limited to a single mid-shaft segment. Both right and left bones have straight diaphyses and the transverse pattern is plano-convex. Two longitudinal bony exostoses occur in the region of the nutrient foramen of the left tibia. Evidence of a heavy ligamentous attachment appears on the left tibia and extends 30 mm. This is not a healed fracture but suggests an unusual degree of rugosity of

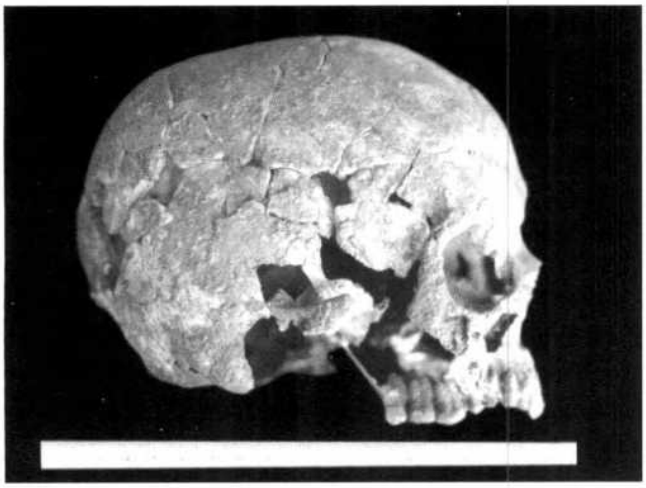

Fig. 22: Tenneru: No.1/70B, cranium, right lateral aspect

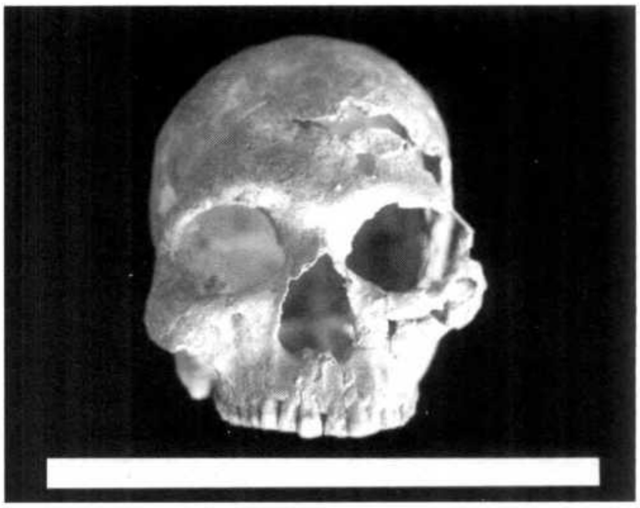

Fig. 23: Tenneru: No. 3/70, cranium, frontal aspect

the tibial bones. Tarsal bones and phalanges, while present, are not suitable for mensuration.

Specimen No. 4/70 (Figs. 28-32)
These human remains are those of a child of 5-6 years of age as determined by degree of cranial suture closure, dentition, and development of proximal and distal extremities of bones of the postcranial skeleton. The permanent first molars are in the early stage of eruption. Bones of the basalar region of the cranium are absent. A mandible with the deciduous dentition is well preserved, as is the maxilla, but facial bones are fragmentary. A metopic suture is present. Temporal bones are preserved and an earlier study resulted in placing wooden struts to support this portion of the cranium. Bones and teeth are relatively complete. Present are a mandible, a left fragment of a scapula, and pieces of a proximal right ulna. Fragments of right and left ilia can be identified. Pieces of femora and tibiae are preserved, but bones of the hands and feet are missing. The sex of the child is uncertain.

Specimen No. 5/70 (A) (Figs. 33-34)
This is a well preserved cranium although the basicranial region, including the foramen magnum, is missing and there is a slight degree of warping. Sutures of the vault are closed posterior to bregma. The right and left lambdoid sutures are visible. A large accessory ossicle appears on both sides of the vault at asterion. There are no other epipteric banes present. The occipital bane has a small torus and a slight chignon. In its superior aspect, the vault form is ovoid. Mastoid bones are narrow and thin, but the supramastoid crests are mound-shaped and well developed. Brow ridges are prominent and continuous. The supraorbital notch is broad and shallow. Palatal shape is parabolic with flattening of the anterior aspect of the arcade. There is no palatine torus. Nasal depression is slight, but the nasal bridge is missing. Only in the alveolar areas of the upper and lower jaws is slight degree of prognathism. Nasal sills are dull and there is no guttering. This cranium is that of a male about the age of 30-40 years, as determined by suture closure of the vault, dental data and complete epiphyseal union of the long bones.

The mandible is complete save far the loss of bone at the left gonial region which had been reconstructed at an earlier date from four articulating pieces. The mandibular dental arcade is U-shaped. The mental eminence is median and prominent. Although there is no mandibular torus, the mylohyoid crests are prominent. The gonial-corpus angle is 80 degrees. Lingual tubercles are sharply painted and large.

The maxillary permanent teeth are present, save for the RLM3. The lower dentition contains RLI1, RI2, RC, RP1, RLP2 and RM1. The left molar row has teeth in their alveoli, but crowns are broken off. Lost antemortem are RM2 and RM3. Alveolar resorption is beginning at the loci of the lost RM3. Anterior tooth wear is pronounced for the upper and lower incisors which are worn dawn to stubs. Premolar and molar teeth exhibit advancing wear, a feature common among early middle-aged males from other Indian Iron Age sites. Alveolar prognathism is pronounced. There is no evidence of caries in this individual's dentition.

An incomplete right clavicle was reconstructed from two fragments of the diaphysis, but extremities of the bone are lost. A single conoid tubercle is round in shape and the infraclavicular crests are not elevated or sharp. Nor are loci of attachments of prominent muscles obvious. Two fragments of a right humerus are portions of the diaphysis of right and left left bones; proximal and distal ends are missing, save for the olecronon fossa of the right humerus. There is no torsion of the mid-shaft portions. The olecranon fossa is not perforated. The deltoid tuberosity is not pronounced on either bone. The right radius is complete, although broken into two pieces which were mended by some previous investigator. The radial tuberosity is smooth and not robust. Interosseous crest is weakly developed. Osteoarthric lipping is absent. A healed lesion appears on the disto-lateral surface and suggests a sharp-type wound inflicted a year or so before death since complete ossification of the small callus. The left ulna is relatively complete save for the distal end and styloid process. The bone has been restored from three articulating fragments, but since the time of its restoration it has broken into two parts. The supinator crest is not hypertrophied. The interosseos crest is low. If this bone is from the same specimen labelled No. 5/70, its morphology does not support the estimate that the individual is male. It is possible that the left ulna does not belong to the other bones of the skeleton. Fragments of the left hand include a pisiform bone, metacarpals 1, 2, and 3 and manual phalanges 2 and 3. Epiphyseal union is complete.

Right and left femora are present, the right femur being the better preserved as a single piece. The distal end of this femur is broken at the level of the adductor attachment. The left femur is broken into several large fragments, and these have not been mended. This same bone is lacking the caput and damage appears at the level of the lesser trochanter. There is marked A-P curvature of the left diaphysis and a very prominent linea aspera, a feature encountered on the right femur as well. The build-up of the linea aspera of the right femur forms a pilaster. There is moderate lipping encircling the caput and neck of the lesser trochanter; a feature resulting from stress such as may occur in excessive walking over rough terrain. The mid-shaft transverse section is round. Diaphyses of right and left tibiae are preserved as a series of articulated segments of which the proximal end of the left tibia and its intercondylar eminence is present. The popliteal line is represented by one-half of its distal end on the right tibial shaft. The left tibia is broken off just superior to the proximal mid-shaft and superior to the fibular articulation. Eight articulating fragments of the left tibia are present. Ten articulation fragments of the right diaphysis have been restored. The transverse pattern of both diaphyses is triangular. The intercondylar eminence of the left shaft is well preserved. A left tibial shaft is preserved and earlier restored from seven fragments. Neither proximal nor distal ends of this bone are present. There is a well developed interosseous crest along with deep and prominent ridges. Tarsal bones are very fragmentary and do not include all of the bones of the ankle, metatarsals and phalanges.

Veerabyina Kunta
Discovered in 1958, this is a megalithic site of cairn circles and cist burials located some 4.8 km north-east of Yelleswaram. Secondary burials with parts of poorly preserved skeletons are present. Excavation was resumed in 1959.

Specimen No.1 /59 from Megalith I (Figs. 35-37)
This is a relatively complete cranium with facial fragments, but there is damage of the left mastoid process, palate and both zygomatic processes. Squamous portions of the temporal bones have pulled apart from the vault. Preserved long bones and teeth and degrees of cranial suture closure indicate that this individual was an adult male over 30 years. There is a prominent supraorbital torus and large glabella. The

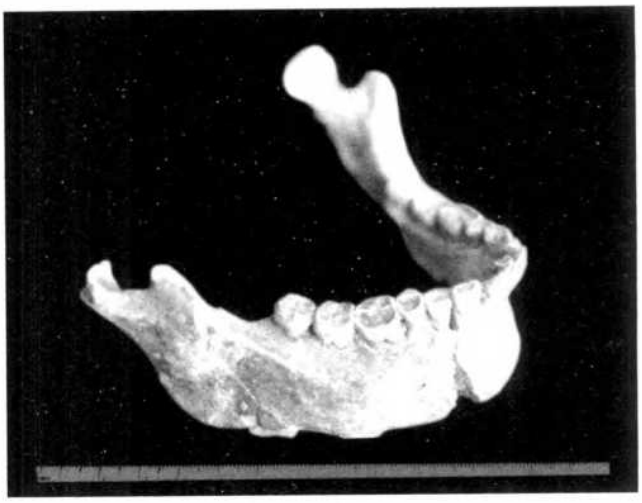
Fig. 27: Tenneru: No. 3/70, mandible, right lateral aspect

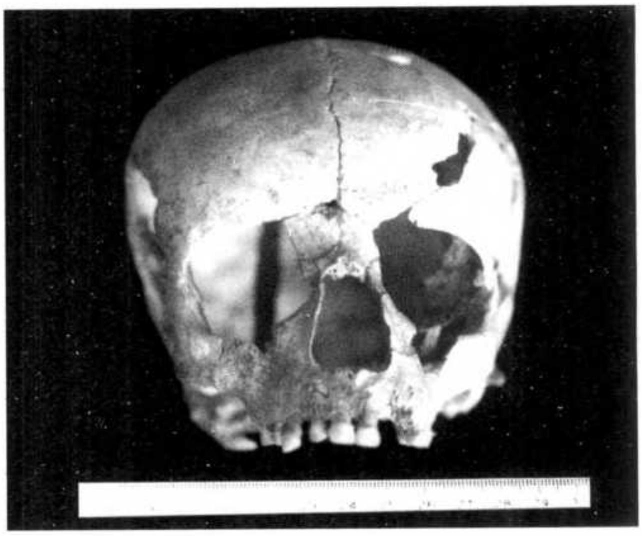
Fig. 28: Tenneru: No. 4/70, cranium, frontal aspect

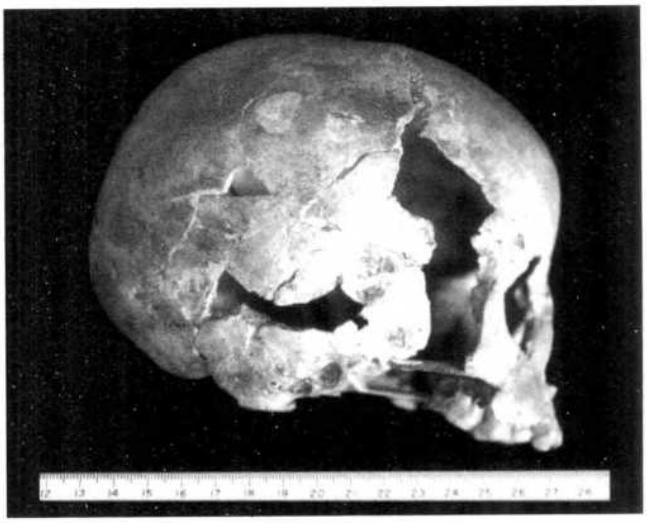
Fig. 29: Tenneru: No. 4/70, cranium, right lateral aspect

Table 4: Dental crown measurements and indices

Specimen	Jaw	Tooth	Side	MD	BL	CA	CI	CM
Kadampur 1/4 (A) Megalith IV	Mandible	M1	R	9.00	9.00	81.00	100.00	9.00
			L	9.10	9.00	81.90	101.11	9.05
		M2	R	(8.60)	9.90	85.14	86.86	9.25
			L	8.40	9.20	77.28	91.30	8.80
		M3	R	10.30	8.40	86.52	112.61	9.35
Tenner Sp. 3/70	Mandible	I1	R	8.2	-	-	-	-
			L	8.3	-	-	-	-
		I2	R	7.4	-	-	-	-
			L	7.6	-	-	-	-
		C	R	7.0	-	-	-	-
			L	6.8	-	-	-	-
		P1	R	6.7	-	-	-	-
			L	6.2	-	-	-	-
		P2	R	10.7	8.3	88.81	128.92	9.50
			L	10.2	8.0	81.60	127.50	9.10
		M1	R	8.6	10.3	88.58	82.49	9.45
			L	8.9	10.0	89.00	89.00	9.45
		M2	R	8.5	9.3	79.05	91.40	8.90
			L	7.4	9.7	71.78	76.29	8.55
		M3	R	7.1	9.2	65.32	77.17	8.15
			L	6.5	9.3	60.45	69.89	7.90
Sp. 5/70	Mandible	I1	R	6.7	4.3	28.81	155.81	5.50
			L	7.0	4.5	31.50	155.56	5.75
		I2	R	5.5	7.5	41.25	73.33	6.50
			L	5.0	7.7	48.50	64.94	6.35
		C	R	8.0	-	-	-	-
			L	7.5	-	-	-	-
		P1	R	6.8	9.5	64.60	71.58	8.15
			L	6.6	9.5	62.70	69.47	8.05
		P2	R	9.5	8.5	80.75	111.76	9.00
			L	9.5	8.9	84.55	106.74	9.20
		M1	R	10.4	11.2	116.48	92.86	10.80
			L	9.8	11.0	107.80	89.09	10.40
		M2	R	10.1	10.0	101.00	101.00	10.05
			L	9.0	9.0	81.00	100.00	9.00

forehead is moderately inclined but retains a bulbous form because of a broad median frontal eminence. Nasion depression is shallow. The temporal lines are sharp but do not extend to the parietal bones. The latter have large bosses. A prominent superior nuchal crest appears on the occipital bone and is continuous with the external occipital protuberance. The preserved right mastoid process is low and the digastric fossa is shallow. There is a moderate supramastoid crest. Temporal fullness is distorted because of warping. The face is euryprosopic, mesene, and hyperchamaerrine with hypsiconchic orbits. Inferior orbital margins are dull. Nasal sills, while damaged, appear to be origmocraspedotic. The subnasal region is very short. The palate is small, narrow and deep. The degree of alveolar prognathism is low. The LM3 has completely erupted. This individual has male morphological features.

The associated mandible does not articulate with the maxilla at the mandibular fossae of the cranial base due to damage, but the condylar orientation is strongly indicative that it belongs to the same individual. There is considerable remodeling of the corpera due to antemortem tooth loss of the molar teeth on the right and left sides of the corpera. The mylohyoid ridge is pronounced. Genial tubercles are low. The mental eminence is prominent and median in form. The sigmoid notch is shallow. There is antemortem loss of all mandibular molars except for LM1. Wear on this tooth is severe and this condition is the same for LPM2.

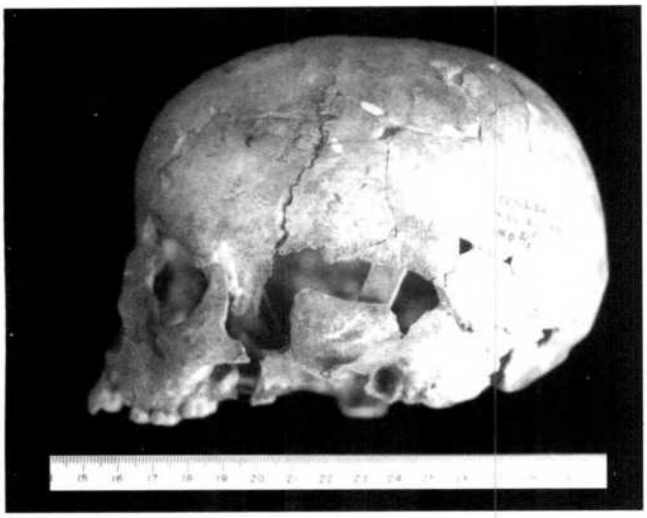

Fig. 30: Tenneru: No. 4/70, cranium, left lateral aspect

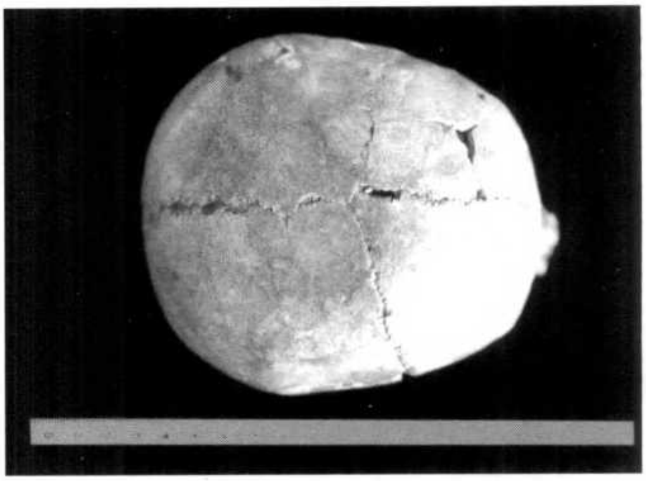

Fig. 31: Tenneru: No. 4/70, cranium, superior aspect

Postcranial bones are fragmentary mid-shaft diaphyses except for one left tibia. The diaphysis is straight with slight head retroversion. The tibial tuberosity is large.

Specimen No. 3/59 at Megalith I

This individual is represented by a very incomplete calotte showing considerable erosion of portions of the frontal, parietals and occipital. Sagittal and occipital sutures are patent, but widely separated because of post-mortem erosion. Since almost all diagnostic features for estimation of age and sex are missing, the identification of the individual as an adult female remains uncertain. The parietal eminences are well developed and a vertical view of the cranial vault shows an ovoid shape. A wormian bone appears at *pars lambdica* of the right lambdoid suture.

Specimen No. 5/59 from Megalith I

This is a calotte with frontal, parietals and portion of the occipital bone. There are fragments of the temporal bones and cranial base. Glabella is not present. The frontal region is markedly "divergent" and metriometopic. The vault is broad and moderately elevated. The supraorbital torus preserved on the right side is low. Frontal inclination is prominent and the parietal eminences are very prominent. The supranuchal crest is low and the external occipital protuberance is a mere trace. The coronal suture is preserved only at *pars media* and shows considerable advancement in closure. Portions of the occipital suture are patent. Some endocranial porosity appears at lambda. Morphologically this individual may be a female of over 35 years.

Specimen No. 6/59 at Megalith I

This is a calotte with frontal, right and left parietal bones, and right temporal bone. Basalar portions are absent. An extraneous occipital fragment had been set into the medial frontal bone area by a previous investigator. This is a dolichocranic individual with sharp and prominent external occipital protuberance and a well-marked superior nuchal crest. A prominent chignon is adjacent to a lambdoid depression. Inferior nuchal crests and ligamentum nuchae are also well defined. While these are features found most commonly in males, the right mastoid process is very short and does not extend beyond the plane of the inferior border of the external auditory meatus. The supramastoid crest is continuous with an elevated ridge of the missing zygomatic process of the left temporal bone. The digastric fossa is short (19 mm) and deep. The frontal region is low and vertical with reduced frontal eminences. A small portion of the right temporal line shows that it is sharp, but does not extend posteriorly by more than 5 mm. Parietal eminences are of moderate development. All cranial sutures are visible, but there is complete closure at *pars obelica*, *pars media* and at *lamdica* along the right lambdoid suture. The degrees of coronal closure is difficult to assess but synostosis is complete at *pars bregmanica*. From what can be observed, this is a male individual of more than 30 years, suture closure timings occurring between 29 to 32 years.

Specimen No. 7/59 from Megalith I

This individual is represented by a calotte with a frontal bone, parietal bones, occipital bone and right temporal bone. The cranial base is missing. A break runs diagonally from glabella to the left pterion region. There is an aperture at the right side of the frontal bone adjacent to the coronal suture. The vault is brachycranic and has a low and bulbous frontal region with moderately developed temporal lines. There is a prominent medial frontal eminence and the parietals are prominent. The occipital bone has even curvature with very low superior and inferior nuchal lines. The external occipital protuberance is weakly developed. Sutures are visible but severely eroded. The right mastoid process is short and broad with a moderate to low supramastoid crest. Present is a segment of the superior margin of the right orbit.

A brief catalogue of human remains from Veerabyina Kunta was compiled in 1963 by the second author of this part of the study in preparation for the prospect of returning to Hyderabad and conducting a more thorough examination of the skeletons. It was not until 1988 that a second opportunity of laboratory research of the collection made this possible. However, at that date many of the specimens were found to be lost or wrongly catalogued, an unfortunate situation that places cataloguing other burial specimens from Andhra Pradesh at risk. A written record of skeletons and artefacts maintained at the Museum of the Department of Archaeology, Government of Andhra Pradesh, Hyderabad, contained the following information given in Table 5.

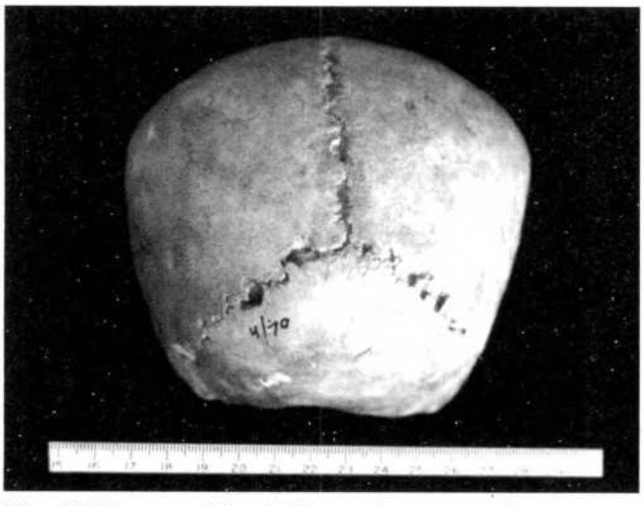

Fig. 32 Tenneru: No. 4/70, cranium, posterior aspect

Discussion

There is considerable phenotypic variability in the skeletal series described above. This is not surprising when one considers that single or a few human skeletal specimens from a given site are not "typical" representatives of their respective gene pools. Only significantly large burial collections from selected sites can offer a fuller comprehension of the "normal" range of a population's physical diversity. The morphometric studies of other Indian Iron Age skeletons cannot accurately measure degrees of polymorphic variability. This is for the reason that archaeologists, geochronologists and geologists can offer chronologies which fall into a relatively broad spectrum of time. In short, the Indian Iron Age individuals whom we recover in burials from the four megalithic sites discussed in the present study are likely to have been living individuals during periods of time separated by decades and even centuries from other Iron Age populations.

With this caveat in mind, there is a positive recognition among today's palaeoanthrologists of the new scientific advancements made in human skeletal biology. This is an interdisciplinary field of study in which human genetic and palaeoecological studies supplement the insights of the scientists who seek to reconstruct ancient lives from skeletal data as well as inquire about adaptive factors in the past and present course of hominid evolution. Some examples from the present study follow.

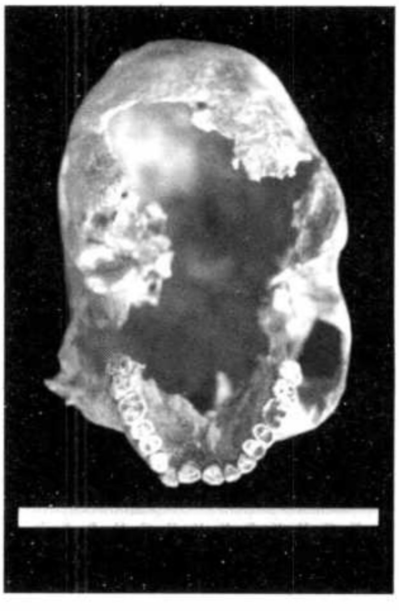

Fig. 33: Tenneru: No.5/70A, cranium, basalar aspect

Stature: Body heights of living males and females were recorded by foreign anthropologists during the nineteenth century, the early reports implicitly supporting a bias that tallness correlates with cultural superiority. Shortness was thought to be diagnostic of lower cultural and "racial" status encountered in "inferior castes" and tribal populations. Stature was a significant character in the *Census of India, 1901* under the direction of Herbert Risley (Risley and Gait 1903) of the Bengal Civil Service. The *Census* included anthropometric data derived from various castes and tribes which were divisible into seven "racial" groupings. Prehistoric human skeletal remains from South Asia were included in the entries of the *Census of India,* 1931 (Guha 1935). Thus stature became a significant criterion in defining "races" and degrees of biological affinities between human populations today and in the past. Body heights of males, females and children were taken with an anthropometer or a measuring tape with the subject in an erect standing position often standing against a wall with a metric scale in a place.

In this present study, estimation of stature of skeletal subjects employed the regression formulae developed by Trotter (1970) from mensural lengths of long bones of individuals whose statures in life had been recorded. Trotter's procedures for "White" males and females are more appropriate for South Asians than those applicable to "Black" and other populations. Other procedures for stature estimations have proven to be less accurate for South Asian subjects (Athawale 1964; Fully 1956; Rexter *et al.* 2007). Adult stature decreases with age in both sexes (normally a 2.54 cm per ten years after the commencement of the mid-third decade of life). Therefore age determination of living and skeletal subjects merits attention prior to anthropometric procedures.

Stature estimates for Tenneru and Veerbyina Kunta are limited to three individuals for whom long bone measurements of upper and lower extremities were taken with an osteometric board. This small "sample" fails to provide the investigator with accurate information of the range of variation within a skeletal series, and where specific stature values fall within that range. In short, the body height estimates of skeletons from these two sites are not "typical" of all members of their habitat. Therefore, the stature estimates for the two males and single female given in Table 6(old5) may suggest sexual dimorphism with females having the lowest stature, the males somewhat taller. The stature value for the male skeleton at Veerabyina Kunta is based upon a single bone- the tibia- and were additional long bones available for this individual the investigator could achieve a more realistic assessment of his stature in life.

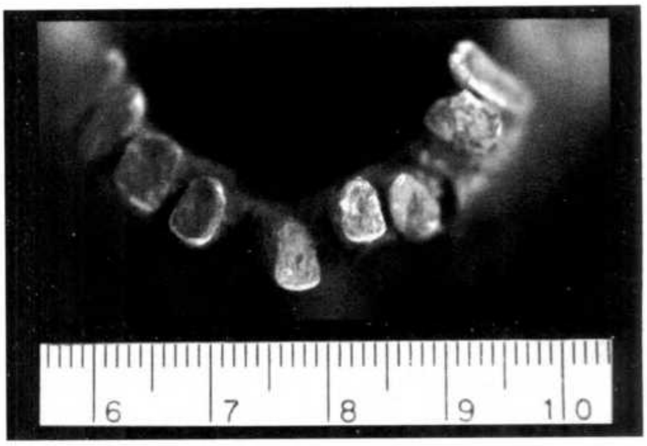

Fig. 34: Tenneru: No.5/70A, mandible, superior aspect

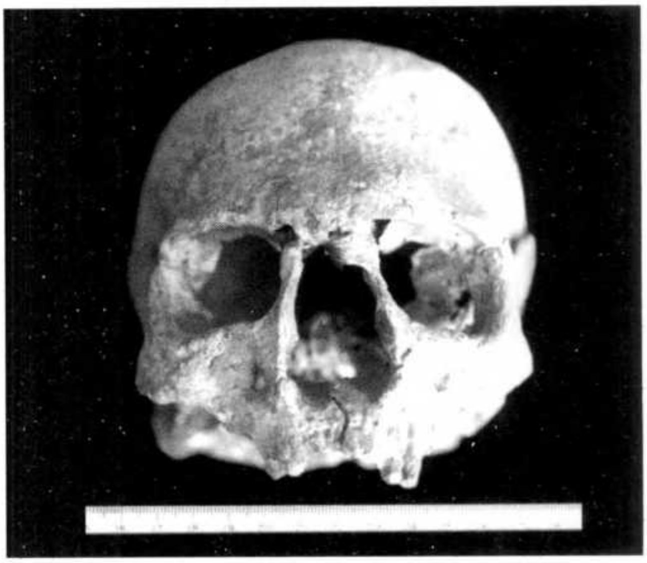

Fig. 35: Veerabyina Kunta: No. 1/59, cranium, frontal aspect

Comparative studies of stature estimations in other Iron Age sites reveal the relative position of values obtained from Tenneru and Veerbyina Kunta (Table 7). The stature values for females at Tenneru are strikingly lower than those within other Iron Age specimens in neighbouring areas.

An essential part of the Bearnstein and Kennedy study (1990) was the question of relationship of body height and biological adaptation. Relatively

Table 5: Information about human remains from Veerabyina Kunta

Specimen No.	Inventory	Age	Sex
1/59 from Megalith III	Maxillary teeth still present are RM2, LC and LI2. Very poor condition. The skull is large with pronounced frontal torus and inclined frontal bone. The vault is higher than in Yeleswaram specimens. Pronounced musculature.	Adult	Male
2/59	Skull cap showing frontal inclination and some frontal bossing.	Adult	uncertain
3/59	Skull cap with occiput and parietals. One wormian bone on each side of the lamboid suture. Moderate elevation of vault	uncertain	uncertain
4/59	Pieces of skull. A single RM1 shows moderate occlusal wear.	Adult	uncertain
5/59	Skull cap. Very broad head with massive bossing on the parietals. Apparent artificial aperture 50 mm high on (the) right parietal bone. Frontal region is bulbous with a wide frontal diameter.	uncertain	uncertain
6/59	Pieces of skull. Thin bone suggests a child burial.	uncertain	uncertain
7/59	Skull cap. Vertical frontal bone with some bossing. Appears acrocranic and brachycranic.	Adult	uncertain
8/59	Badly crushed skull with a few isolated teeth. No attrition on the occlusal surfaces of these teeth.	Young adult	uncertain
9/59	Pieces of skull. Bulbous frontal bone suggests a female individual. While bone is not thick, it appears to be that of an adult. Very small mastoid process with a pronounced digastric fossa on the left mastoid.	Adult	Female
10/59	Skull cap mended from several pieces. Mesocranic. Aperture on the right parietal bone near the suture at *pars obelicus*. Vertical frontal bone.	Adult	Male?
11/59	Pieces of skull cap. Very thin bones, especially at the frontal region. The frontal bone is moderately inclined with moderate brow ridges. Muscularity is low.	Adult	uncertain
12/59	Pieces of skull and mandible with unerupted first molars. Deciduous (lower) dm2. Pieces of skull and mandible. Minimal wear on the dm2	Child of about four years	uncertain
13/59	Skull cap. Very broad skull. Probably male. Low inclined frontal bone. Low supraorbital torus. Bones of the skull cap are thick	Adult	uncertain
14/59	Pieces of skull and mandible. Full permanent dentition present. Molars show moderate wear. Direction of wear is buccal. Perhaps more than a single individual (is) present here.	Probably adult	uncertain
15/59	Skull cap. Assemblage of many cranial fragments and mandible. Brachycranic. Low bulbous frontal bone. Pronounced parietal bossing. Pieces of mandible with teeth belong to two different individuals. Molars and premolars present, and these exhibit moderate degrees of wear.	Adult	uncertain
16/59	Pieces of skull and mandible. Loss of LM3 and LM1. Considerable absorption of alveolar region of the mandible. The ramus is prominently inclined. The mandibular corpus is thick.	Perhaps an adult of advanced age	uncertain

lower stature values for southern India's Iron Age people may be due to stresses related to diet with an inadequate protein supplement to agricultural and domesticated animal products (Kennedy 1984; Takahishi 1971). Changing climatic and temperature conditions occur in a tropical environment in a year's cycle or over many decades; such conditions may have contributed to a failure of individuals to attain their full ontogenetic potential, especially under circumstances of famine. Or lower statures may be adaptive in populations under chronic food deprivation (Stini 1975). Relaxed selection for tallness is another possibility. And there is plasticity of phenotypic responses imposed by cultural lifeways for which the archeologist seeks various underlying causes. In general, stature variability in prehistoric and modern populations of South Asia tends toward lower body heights in the southern portion of the subcontinent.

Cranial morphometrics: The shape of the human cranial vault when viewed in *Norma Superious (verticalis)* may appear narrow, broad or of an intermediate shape. A scientific method for measuring this variable was introduced in 1840 by the Swede

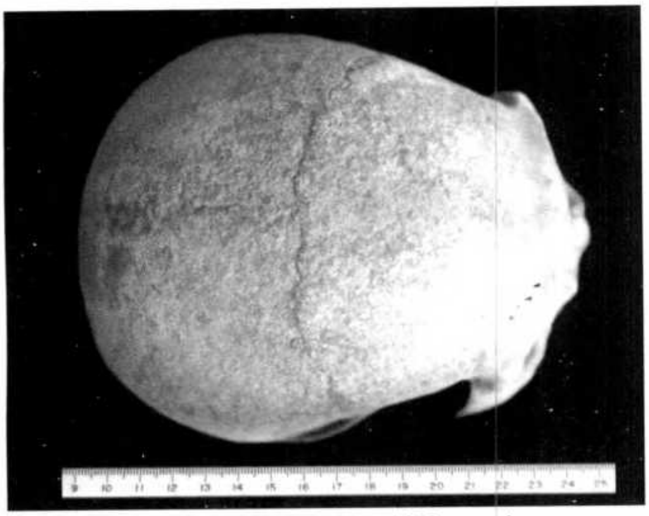

Fig. 36: Veerabyina Kunta: No. 1/59, cranium, superior aspect

Anders Retzius (1842). He measured the maximum length and breadth of a skull with the use of calipers and calculated the ratio called the "cephalic index" or "cranial index". Retzius classified these into three groups: "dolichocranic" (long-headed with indices of 75 - 74.9); "brachycranic" (broad-headed with indices of 80 - 84.9); "mesocranic" (with indices of 75.0 - 79.9). Many cranial vaults exceed these individual values except for "mesocrany") and may have the prefaces of "ultra" or "hyper", e.g. "ultradolichocranic".

Following Retzius' observation that many human populations living at high latitudes, as in Scandinavia, were long-headed, early twentieth century anthropologists conceived the "cephalic/cranial index" to be a major key to racial classification. Although other measurements and indices were applied to the skull and bones of the postcranial skeleton, and different types of anthropometric instruments became available, a goal of nineteenth and early twentieth century was to apply their data acquired from living and skeletal subjects for racial classifications. With the collapse of the traditional race concept since the second half of the last century, anthropometric measurements continue to be taken, but with different purposes, namely observations of phenotypic variation within the context of adaptation and natural selection, genetic features of which some occur in different frequencies in world populations, understanding shape and size variables of ancient and modern hominids (hominines) within the context of evolution, and applying anthropometric data to social problems of growth, development and health in disadvantaged sectors of the modern world. Applications of anthropometric data to military, space travel and engineering purposes is yet another aspect of the discipline of biological anthropology in first years of 21st millennium.

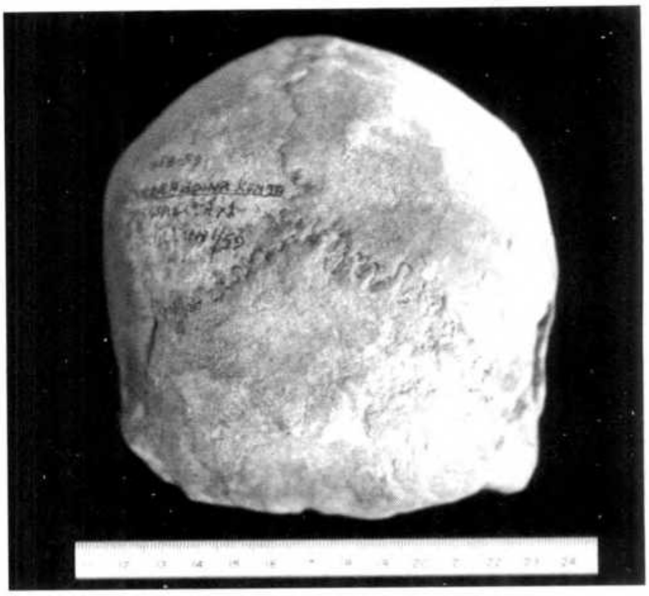

Fig. 37: Veerabyina Kunta: No. 1/59, cranium, posterior aspect

The cranial/cephalic values are now understood to be a single and limited example of a phenotypic variable no longer viewed as a critical marker of race classification. Table 2 illustrates the diversity of cranial shapes in a sample of Indian Iron Age individuals of which some are described in the present study. If other cranial indices for the face, mandible and cranial base, as well as for postcranial mensural values, were plotted on a bivariate scattergram structured in the same axes represented in Figure 38, then the distribution of selected variables would be unique, i.e. not correlated with the form of the cranial vault since each set of traits would have different loci of distribution of phenotypic gradients in space and time.

Non-metric variables and discrete traits add information about form and shape of skeletal elements and are quantifiable by assigning specific traits to classifications of morphological categories. For example, in the examination of the skeletal specimens from Tenneru the investigators encounters considerable variation in the extent and robusticity of the femoral linea aspera, a variable that may be related to the sex of an individual, age at time of death, and marker of occupational stress (MOS)

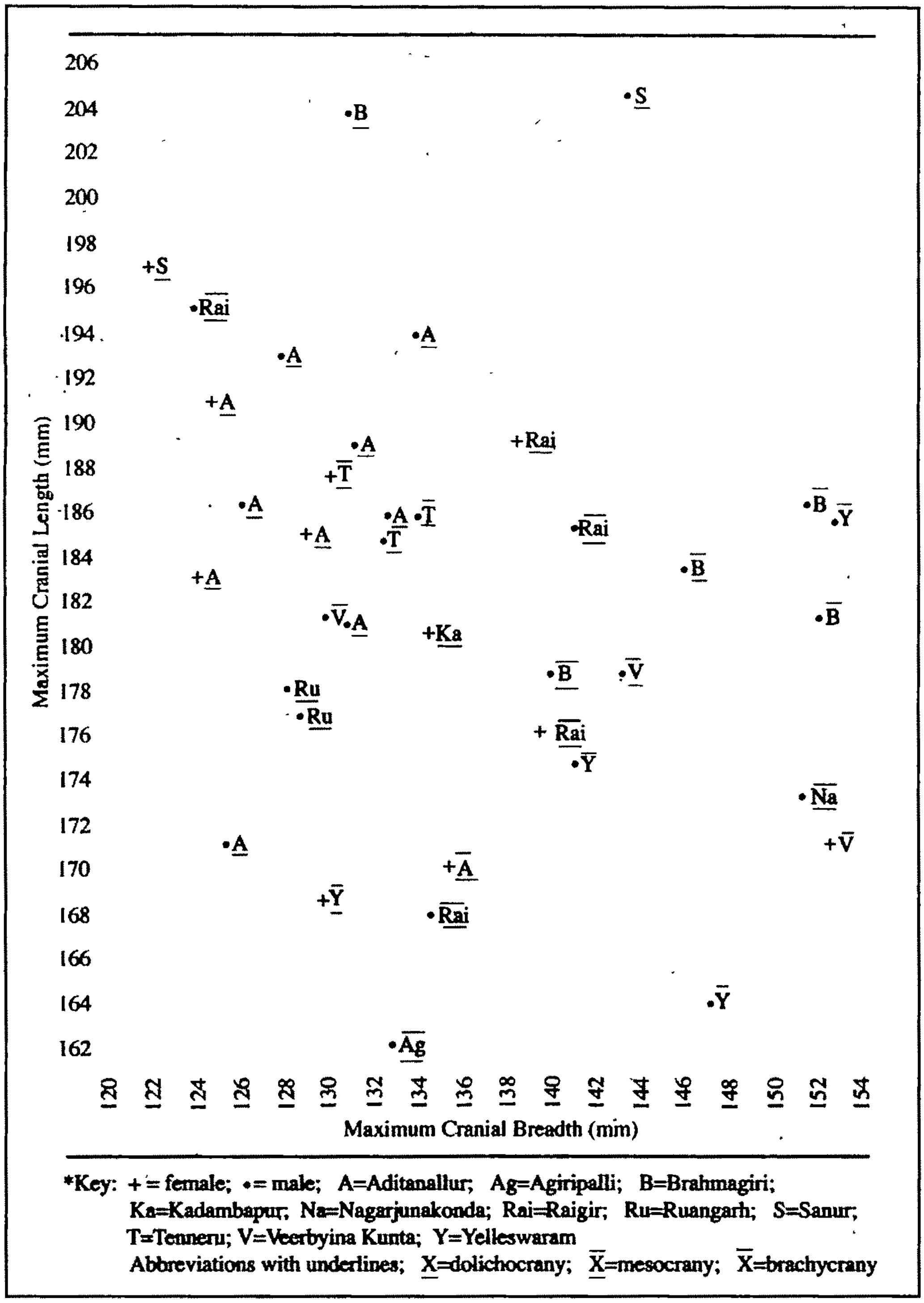

Fig. 38: Scatter diagram of comparative cranial indices

(Capasso et al. 1999; Wilczak and Kennedy 1998), trauma and disease.

Pathology and Trauma: Given the fragmentary condition of the human remains described above, only certain pathological markers are identifiable. Apart from dental analysis, those encountered are noted in Table 8 (old6).

Osteoarthritis is not a frequent condition in these skeletons, perhaps because of their relatively young ages at time of death. Dental caries are not present, although severe dental wear, particularly of the upper and lower premolars and molars, is present. Enamel hypoplasial lines were not frequent in these specimens. It would overstate the apparent absence of

Table 6: Stature estimation for Tenneru and Veerabyina Kunta

Sp. No.	Sex	Bone	Side	Bone length (mm)	Stature estimation (cm)
			Tenneru		
1/70 B	F	Humerus	L	281	1520 ± 4.45
		Radius	R	176	1300 ± 4.24
		Ulna	R	203	1440 ± 4.30
		Tibia	R	282	1430 ± 3.66
		Fibula	R	276	1420 ± 3.55
		Mean	-	-	1422 cm (4'7")
5/70 A	M	Humerus	L	331	1720 ± 4.45
		Radius	R	274	1820 ± 4.24
		Femur	R	402	1570 ± 3.72
		Tibia	L	295	1530 ± 3.66
		Fibula	L	322	1580 ± 3.55
		Mean	-	-	1644 cm (5'4")
			Veerabyina Kunta		
9/59	M	Tibia	L	433	1800 ± 3.66
		Mean	-	-	1800 cm (6'2")

Note: The longer of paired bones was used for stature estimation based upon the formulae of Trotter (1970) for White males and females. Where there is marked discrepancy in long bone lengths ascribed to the same individual, commingling of remains requires consideration.

Table 7: Stature estimations in Iron Age sites

Site	Sex	Stature (mm)	Published source
Brahmagiri	male	1648	Sarkar 1972
	male	1728	
Nagarjundakonda	male	1700	Gupta *et al.* 1970
	male	1730	
	female	1628	
	female	1615	
Pochampad	?	1799	Kennedy 2002
Yelleswaram	male	1754	Sarkar 1972;
	female	1673	Kennedy 2000b
S. Pappinayakanpatti	male	1731	Walimbe and Selvakumar (1998)

certain pathological and traumatic markers to argue that these Iron Age individuals enjoyed good health. Their way of life included agriculture and herding of cattle and caprids and sedentary settlements. In many other food-producing populations of the Iron Age cultural tradition populations were faced with occasional food shortages due to fluctuations of rainfall and poor soils for cultivation. Traumatic markers, often on the head, are more frequent in village and urban life than in earlier hunting-foraging socioeconomic conditions where postcranial injuries predominate because of accidents associated with movement across stony and irregular ground and interpersonal aggression (Buikstra and Ubelaker 1994). Markers of occupational stress occur as a consequence if a broad range of behaviours (example Molleson and Hodgson 1993).

Summary

Human burials from four Indian Iron Age sites in Krishna district in Krishna District, Andhra Pradesh, India were examined by P.C. Caldwell-Ott and K.A.R. Kennedy in 1963 and 1988 at the Department of Archaeology, Government of Andhra Pradesh. Apart from the scientific value of a published record of the morphometric data of skeletons from the archaeological sites of Agripalli, Kadambapur, Tenneru, and Veerbyina Kunta (hitherto undiscribed), the present investigators sought to retest the venerable hypothesis that the megalith builders and iron-users were "racially distinctive" and phenotypically homogeneous migrants into southern India and Sri Lanka during the period of 500 - 350 B.C. to 50 A.D. Some anthropologists assumed that the original homeland of this mysterious population was in Central Asia (Sarkar 1960, 1972).

Results of the recent study do not support Central Asia-India Migration hypothesis. The degrees of phenotyic variability observed in the human remains from the four Iron Age burial sites noted

Table 8: Incidence of palaeopathological lesions and anomalies

Site	Specimen No.	Pathology / Anomaly
Agiripalli	No.1	Treponematosis?
Kadambapur	No. 2-4, Skull 2, Megalith IV	Periodontal disease, Leg amputation
Tenneru	No. 1-70 B	Antemortem tooth loss
	No. 370	Crowding of upper incisors
	No. 5-70 A	Healed lesion on right radius, Severe dental wear
Veerbyina Kunta	No.1-59, Megalith 1	Severe dental wear

above, and comparative morphometric analyses with neighbouring Iron Age skeletons in other burial sites make it clear that scientific evidence of foreign origins is wanting. Rather, normal ranges of cranial and postcranial phenotypic variables are apparent. One example refers to striking differences in head shape in specimens of both sexes (Table 2). Along with bivariate plots, the investigators applied multivariate analyses to their skeletal sample, once more demonstrating significant levels of physical diversity among populations archaeologically characterized by their construction of megalithic monuments, sophistication in iron technology and wide-spread manufacture of distinctive pottery and painted decorations.

Archaeological investigations lead to a clearer comprehension of the life ways of extinct prehistoric populations, and with the supplementation of data from biological studies more is learned about the life ways and adaptations of the megalith-builders. Valuable as the archaeological record may be, at sites containing burials the investigations of human skeletal remains by well trained biological anthropologists are essential. DNA analysis of ancient bones has been attempted by molecular biologists using osseous and dental samples from several fossils hominid localities in the Temperate Zone. However, in Tropical and Sub-tropical latitudes uncontaminated DNA has not been obtainable thus far (Reed *et al.* 2003; Kumar *et al.* 2000). If future biomolecular methods yield more reliable results, palaeoanthropologists will gain a supplementary approach to determining phylogenetic and kinship relationship that can be derived today from morphometric studies of ancient and living populations in South Asia.

Acknowledgements

This project was made possible by the late Dr. Abdul Moheed Khan, Ex-Director of the Department of Archaeology, Government of Andhra Pradesh Hyderabad who gave permission to two of the authors to examine the Iron Age skeletons from the Iron Age sites discussed in this report as well as other skeletal series from the sites of Pochampad and Yelleswaram. Photography was undertaken by Mr. William Roertgen, then a graduate student at Cornell University. The project was supported by the National Science Foundation and the American Institute of Indian Studies. The first author thanks Dr. Krishnam Raju for the logistic help extended to him during the course of his study.

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Mushrif-Tripathy V. and Jamir T., *Man and Environment* XXXVI(1): 71-78 [2011].
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Study of Two Skeletons from Leshemi: A Burial Site in Nagaland

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Abstract

This article discusses the discovery and analysis of two male skeletons from Leshemi, a Kozami village situated in Phek district, Nagaland. These comprise a young and a middle-aged adult respectively. Important findings include the pathology of the vertebral joint and non-specific infections.

Introduction

Leshemi, a Kozami village is situated about 15 km from Pfütsero town, Phek district of Nagaland, located at 1500 m AMSL (Fig. 1). In order to investigate regional variation in the mortuary practices, a trial excavation at *Theri* locality was undertaken to examine three specific problems: (i) the nature of burial construction practised by the local community, (ii) its nature of interments, and (iii) health conditions of the population. Two trenches measuring 250 x 80 cm and 200 x 100 cm were laid out and two burials were exposed. Two single pit burial types, topped with wooden planks and capstones were uncovered from the excavation. Relying on oral accounts of the villagers, both burials may be assigned to the pre-colonial period contemporary to the Jotsoma burial complex (middle of the 17th century).

Burial 1 (Gr-1)

A row of 6 flat wooden planks was exposed at a depth of 22 cm from the surface, positioned along the N-S axis. On removal of the planks, the pit appeared water-logged. However, every care was taken to dry the pit and expose the remains. The remains of a single male individual lying in an extended position were excavated. The depth of the pit from the surface to the floor was 48 cm (189 cm in length and 82 cm in breadth). The grave was in a simple pit without any stone alignment (Fig. 2). The pit contained a single carnelian (hexagonal type) and a few coloured glass beads from the neck region. An iron spearhead, and a point with its well-preserved wooden handle were also recovered along with two brass bracelets. There were also slight traces of a *lohe* a traditional shawl) around the chest region and outlines of cane leggings on both knee joints, which indicate that the individual was a male. The body rested over a flat wooden plank (171 x 20 cm).

Burial 2 (Gr-2)

The grave was a simple earth-cut pit (183 cm in length and 83 cm in breadth) oriented in NE-SW direction (Fig. 3). With the capstones removed, only the skull was visible while the rest of the body was covered with dark brownish earth. Probably the colour of the soil is due to the wooden plank placed on the grave floor. While the rest of the body was interred in an extended position, the head was placed in an unusual position facing north. The feet rested on two flat stone slabs. Except for the skull and the lower jaw, the remaining skeletal parts were in a fragile condition. Two spearheads and a single butt-end point were recovered from the right side of the body at a depth of 61 cm. The specimen belonged to a male individual.

Material and Methods

The two skeletons uncovered (Table 1) from the Leshemi graves were documented and studied using all standard methods: for age and sex - Brothwell, (1981), Ubelaker and Buikstra (1994); skeletal morphology - Ubelakar and Buikstra (1994), Steckel and Rose (2002); dental morphology -Turner (II *et al.* (1991); cranial metric observations - Martin-Saller (1957); odontometry - Moorrees (1957), Wolpoff (1971), Potter *et al.* (1981), Dahlberg (1963); stature estimation - Trotter (1970) formulae for White populations and for pathologies and anomalies - Larsen (1997), Ortner and Putschar (1981), Roberts and Manchester (1995), and Lukacs (1989).

Received : 23-8-2010
Revised : 02-12-2010
Accepted : 03-04-2011

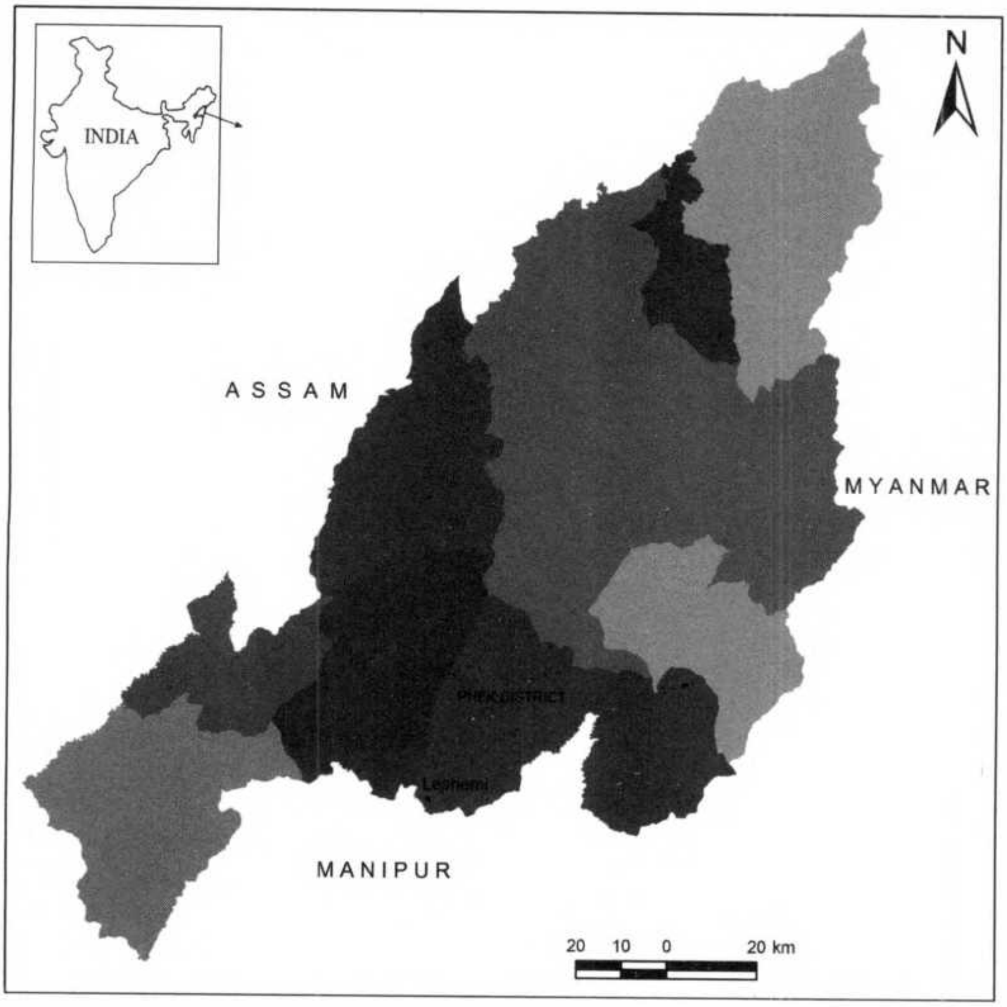

Fig. 1: Map showing the location of Leshemi

Observations

The preservation of skeletal remains from Leshemi is good for carrying out morphometric studies. The outer layer is brittle and the bone surface is broken in small fragments. The teeth are brittle and black in colour. All these post-mortem changes made it difficult to carry out palaeopathological observations on long bones.

Age-Sex Estimation

The individual in GR-1 was a young adult. The teeth show a minimum amount of wear indicating an age of 20 to 25 years. The sciatic notch of this individual is of grade '4' confirming the male sex. The mastoid process also shows grade '4'. The nuchal crest is of grade '2' showing some gracile features. The chin is of grade '2' and the gonial angle is more than 120° indicating female characteristics. It is possible that this individual is a gracile male.

The individual in GR-2 was of 45 ± 5 years on the basis of dental wear pattern and general morphology. The sciatic notch is of grade 5 confirming the male status of the individual. The mandibular angle is less than 120°. The nuchal creast is of grade 3, mastoid process of grade 4, supra-orbital margin of grade 4, supra-orbital ridge of grade 3 and mental eminence is of grade 3. All these confirm the male sex of the skeleton.

Metrical Analysis

Cranial measurements are possible only for the individual in Gr. 2 (Table 2). These measurements can be compared (Table 3) with the measurements of the skull of a male from the Megalithic site of Jotsoma in Nagaland (Mushirf-Tripathy *et al.* 2009). Even if these two share the same range, the value of indices has large differences. The facial region, orbit and upper facial portions are in different ranges. Uncommon dental traits were identified

Table 1: Inventory of the skeletal elements

Grave No.	Skull	Thoracic cage	Upper extremity	Lower extremity
1	Almost complete but preserved in large-, medium- and small-sized fragments. The inventory includes a large piece of frontal, RL supra orbital region fragments, complete occipital, around 18 medium/small sized fragments from parietal and temporal region, RL mastoid with petrous portion, RL zygomatic arch pieces, maxillary fragment with 5 teeth *in situ*, styloid process fragment, from base; basilar, RL wings of sphenoid, mandible damaged, L horizontal ramus fragment unattached Teeth: Maxilla- RLPm2, RLM1, LM2; Mandible- (all isolated) RLPm1, RLPm2, RLM1, RLM2, RLM3	Almost complete 7 ribs from the R side and 11 from L side; also around ten small/medium rib fragments; Vertebral column: Cervical- atlas in 3 pieces, complete axis, 4 other pieces from the region; Thoracic- 8 almost complete, 2 fragments of spinous process, 3 other fragments; Lumber- all present, complete sacrum, part of coccyx	Sternum- complete but damaged. Manubrium- in 3 fragments. Scapula- R small fragment, damage acromion process; L missing parts are coracoid process and acromion, but lateral border with distal part of body other portion present. Clavicle- R shaft fragment, L lateral extremity with part of shaft. Humerus- R almost complete except loss of head and part of diaphysis, L almost complete except unfused head fragment. Radius- R complete but both extremities unfused, L complete. Ulna- RL complete. Few carpals, metacarpals and phalanges preserved.	Pelvis- R almost complete but damaged on iliac portion, L almost complete but preserved in 2 large fragments. Femur- RL almost complete but unfused head and neck fragments. Patella- RL complete. Tibia- RL complete but damaged at proximal side. Fibula- R other than the loss of proximal extremity bone is complete. L complete but damaged at distal extremity. Tarsals- RL talus, RL calcanus.
2	Almost complete, slight damage inside orbits and nasal portion, mandible is complete but with slight damage at R coracoid process (Fig. 4) Maxilla: LC, RLPm1, RLPm2, RLM1, RLM2. Mandible: RI1, RLI2 (isolated), RLC (L isolated), RPm1, RLPm2 (L isolated), RLM1, RLM2, RLM3 (L M1, M2 and M3 isolated)	Approximately 40 small medium sized rib fragment. Sternum and manubrium preserved. Vertebral column; cervical- all present; thoracic- one is missing, some vertebral bodies damaged; lumber- all present but damaged; sacrum preserved in 3 fragments	Clavicle- RL complete. Scapula- R partially preserved, present in 3 fragments (glenoid cavity, axillary border and spine with acromion process); L partially damaged body portion. Humerus- R complete, with slight damage to proximal side; L almost complete but head part is separate, cannot be articulated due to some missing portion of neck. Ulna- R almost complete, distal extremity fragment unarticulated; L almost complete but distal extremity missing. Radius- RL almost complete, distal extremities unarticulated because of partial loss of bone. Carpals- RL navicular; Metacarpals- R 1,2,3 and 5, L 5(?), 4 distal portions of metacarpals (?) unidentified.	Pelvis- R most of the portion preserved but missing parts are pubis, part of acetabulum, and small portion of iliac blade; L preserved in 6 medium sized fragments, identified as part of sciatic notch, ischium, 2 parts of iliac blade and part of acetabulum. Femur- RL proximal extremities damaged with shaft, distal diaphysis missing, distal extremities are damaged and unarticulated; Patella- L complete. Tibia- R shaft with unfused fragmented both extremities. L almost complete with unattached proximal extremity and damaged distal extremity. Fibula- RL damaged shaft with fragment of distal extremity. Tarsals- R navicular, talus, calcanus, cuboid(?), L talus and small fragments of calcanus.

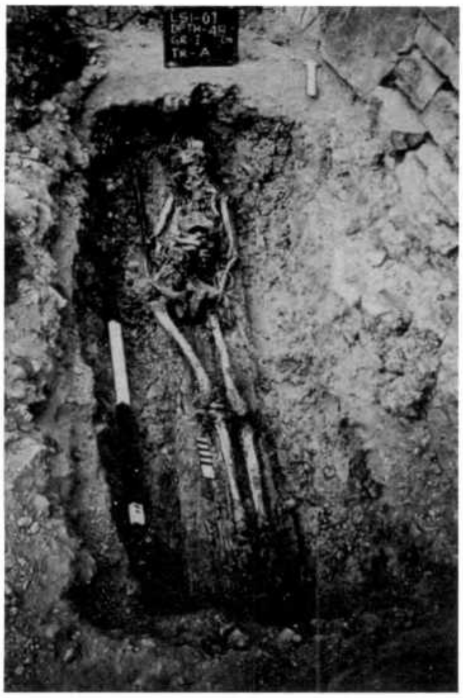

Fig. 2: Gr. 1 *in situ*

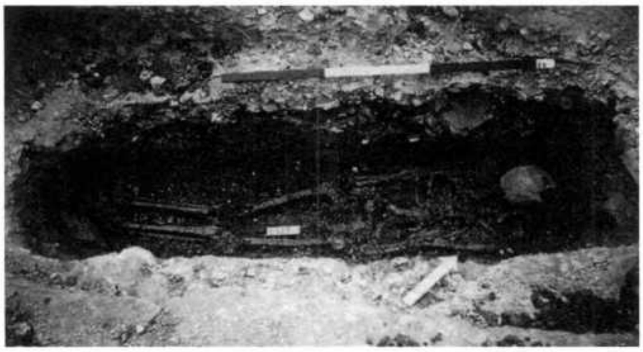

Fig. 3: Gr. 2 *in situ*

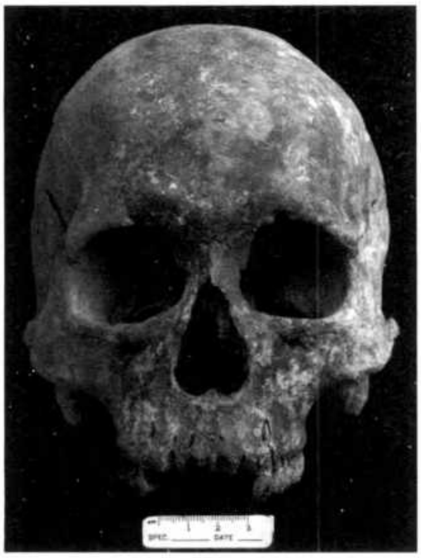

Fig. 4: Gr. 2: *Norma frontalis*

in the Leshmi skeletons. The presence of an extra cusp or root is observed in both the Leshmi and the Jotsoma material. These observations are important for further skeletal studies to understand the physical characteristics of population of Nagaland. In both specimens, long bone measurements (Table 4) and measurements of the teeth (Table 5) were recorded.

Cranial morphology

The supra-orbital notch is present on both sides; a small shaped multiple zygomatico-facial foramen is present for R 2 and for L 3. The infra-orbital suture is complete on both sides; mastoid foramina are present for R side (1) within the occipito-mastoid suture and parietal foramina are present for R side.

Dental morphology

Both RL maxillary molars of the individual in Gr. 1 have a carrebelli cusp of 'grade 5', Hypocone on RLM1 is of 'grade 5' and on LM2 of 'grade 4', Metacone on RLM1 is of 'grade 5' and on LM2 of 'grade 4'. All RL M1 M2 and M3 (mandibular molars) have 5 cusps and the groove pattern on RLM1 is 'Y', M2 '+' and M3 'Y'. Both mandibular first molars exhibit extra root formation on distal root at lingual side (Fig. 5). Slight discoloration pattern is seen on the mandibular teeth, but it is almost absent on maxillary teeth.

The metacone for maxillary RLM1 is of grade 4 and for RLM2 of 3.5 and the hypocone is of grade 4 and 3, respectively in case of the individual in Gr. 2.

Pathology

Localized infections and age related anomalies are seen on both the specimens. Some interesting observations were made which do not have an answer at this stage, but are recorded.

A minimum amount of porosity is seen on the posterior side of disto-lateral aspect of both femurs in case of the individual in Gr. 1. The affected area is 0.5 cm diameter. The porosity may be due to some localized infection. Both R and L first great toe phalanges show bone reaction in the form of depression with some remoulding. The depression has smooth edges and does not show any bone reaction outside the depression. The head of both first metatarsals also do not show corresponding bone remoulding (Fig. 6). All molars from both jaws show 'grade 6' wear pattern.

Table 2: Cranial measurements of individual in Gr. 2

Measurement	Value in mm	Measurement	Value in mm
Maximum cranial length (1)	183	Breadth of upper jaw (46)	97
Glabella inion length (2)	173	Morphological facial height (47)	126
Glabella lambda length (3)	170	Upper facial height, morphological superior facial ht. (48)	(74)
n-ba (5)	96	Anterior inter-orbital breadth (50)	(20)
n-o (5-1)	133	Orbital breadth (51), right left	40 42
Maximum cranial breadth (8)	138	Orbital height (52), right Left	33 33
Minimum frontal breadth (9)	90	Nasal breadth (54)	27
Maximum frontal breadth (10)	128	Nasal height (55)	56
Bi-auricular breadth (11)	129	Maxillo-alveolar length, length of upper jaw (60)	(53)
Greatest occipital breadth (12)	106	Maxillo-alveolar breadth, breadth of upper jaw (61)	67
Bi-mastoid breadth (13)	108	Sub-nasal height (48-1)	18
Basion-bregma height (17)	138	Palatal length (62)	38
Basion vertex height, total height of skull (17-2)	(140)	Palatal breadth (63)	44
Auriculo bregmatic height (20)	138	Palatal height (64)	15
Horizontal circumference of skull (23)	530	External palatal arc (80)	147
Transverse arc (24b)	330	Molar teeth row length (80-3), right Left	29 28
Longitudinal arc (25)	390	Premolar teeth row length [80-3a], right left	15 15
Frontal arc (26)	130	Bi-condylar breadth (65)	125
Parietal arc (27)	145	Bi-coronoid breadth (65-1)	(96)
Occipital arc (28)	116	Bi-gonial breadth (66)	(90)
Frontal chord (29)	111	Bi-mental breadth, anterior breadth (67)	50
Parietal chord (30)	128	Length of lower jaw (68)	87
Occipital chord (31)	100	Chin height, symphyseal height (69)	(40)
Facial length, facial depth (40)	97	Condylar height, height of ascending ramus (70), right left	66 66
Lower facial length, inferior facial depth (42)	109	Height of coronoid (70-1), right left	65 65
Outer bi-orbital breadth, upper facial breadth (43)	104	External mandibular arc (80a)	210
Inner bi-orbital breadth (43-1)	96	Molar teeth row length [80-1a], right Left	33 -
Bi-orbital breadth (44)	96	Premolar teeth row length [80-b], right left	15 -
Bi-zygomatic breadth (45)	127		

In the case of the individual in Gr. 2, the first thoracic vertebra shows localized arthritic problems. The L side transverse process developed a lipping along the superior margin of the rib facet. This development is of grade 3 (gradation based on GHP), which is absent on the articular facet of the R side. The corresponding articular facet of first L rib (tubercle) also indicates bone growth, whereas the tubercle of R side rib shows minimal bone formation. In the thoracic region no other vertebrae and ribs show any new bone development. This is a localized problem seen only on L side of the first thoracic vertebra.

The acetabulum of R pelvis has some deformity. The inferior margin of the anterior side has developed a groove and some bone formation. The femoral head of the same side shows osteophytic growth on anterior side. There is an extension of facet on

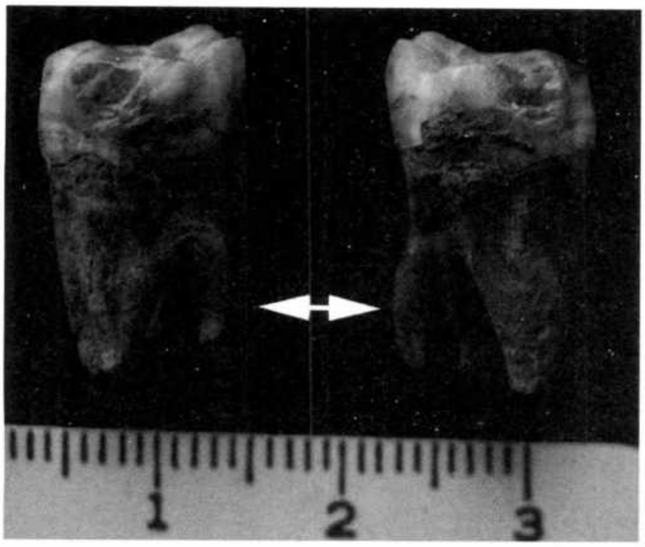

Fig. 5: Gr. 1: Extra root on mandibular RLM1

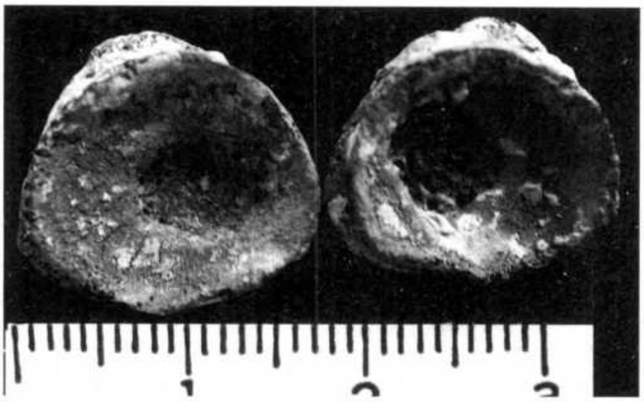

Fig. 6: Gr. 1: Bone remoulding on RL first great toe phalanges

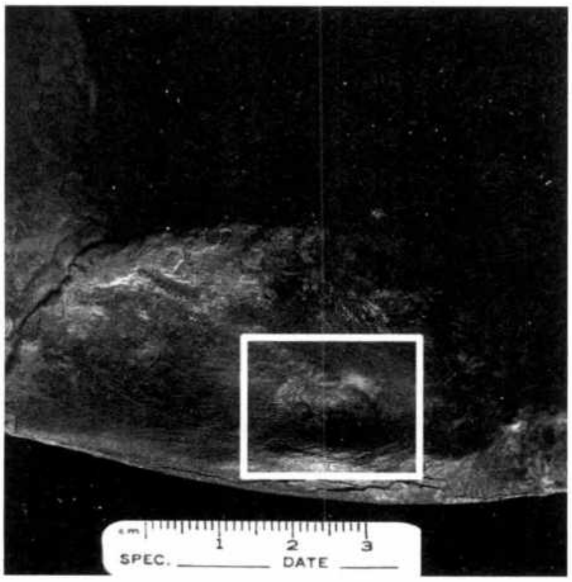

Fig. 7: Gr. 2: Depression on mandibular horizontal ramus

the anterior side of neck region. There seems to be a longitudinal bone growth in the plate area, which indicates the well-healed fracture from a minor injury, but confirmation of the lesion is not possible without a radiograph.

There is a depression on the L side inferior aspect of horizontal ramus, much below the roots of LPm1 and Pm2. The bone is continuous and the edge is smooth and rounded. The affected area is 1.2 x 0.7 cm and approximately 0.2-0.3 cm deep. No new bone formation or inflammation is seen in and around the area. It seems like the depression is some kind of ulcer. It may be caused by a habitual practice of keeping tobacco (smoking pipes made of clay are reported as grave goods in the region) or similar substances below the tongue (Fig. 7).

Table 3: Comparison of Leshemi and Jotsoma cranial indices

Index	Gr. 2 Present study	Jotsoma VII–B
Cranial capacity (Lee-Pearson 1901) (38)	1451.62	1254.00
Cranial index (I 1)	75.40 Mesocranial	69.94 Hyperdolicocranial
Length-height cranial index, vertical index (I 2)	75.40 Hypsicranial	75.72 Hypsicranial
Breadth-height cranial index, trans. Vertical index (I 3)	100.00 Acrocranial	108.26 Acrocranial
Auriculo-vertical index (I 4)	75.40 Hypsicranial	63.58 Hypsicranial
Transverse frontal index (I 12)	65.21 Stenometopic	82.07 Eurymetopic
Transverse fronto breadth index, frontal index (I 13)	67.66 Metriometopic	71.90 Eurymetopic
Total facial index (I 38)	99.21 Hyperleptoprosopic Long face	90.76 Leptoprosopic Long face
Kollman`s upper facial index (I 39)	58.26 Lepton	56.92 Lepton
Orbital index (I 42), right left	82.50 78.57 Mesoconch Medium orbit	97.50 97.50 Hypsiconch Long orbit
Nasal index (I 48)	48.21 Mesorhinae Medium nose	55.55 Chamaerhinae Broad nose
Maxillo-alveolar index, Palato-alveolar index (I 54)	126.41 Brachyuranic	-
Palatal index (I 58)	115.78 Brachystaphylin Broad palate	-
Mandibular index (I 62)	87.60 Dolichosteno-mandibular	63.02 Dolichosteno-mandibular
Palatal height index (I 59)	34.09 Orthostaphylin Medium palate	30.00 Orthostaphylin Medium palate

Table 4: Osteometric data of long bones

		Grave 1					Grave 2				
Bone	Side	M-L	A- P	Girth	Length	Stature (cm)	M-L	A- P	Girth	Length	Stature (cm)
Humerus	R	18	19	64	-	-	21	21	70	31	165.93 ± 4.05
	L	20	19	63	(30)	162.85 ± 4.05	17	20	68	-	-
Radius	R	12	10	40	(24)	169.73 ± 4.32	14	11	43	-	-
	L	13	10	40	24	169.73 ± 4.32	15	11	48	-	-
Ulna	R	12	13	45	25.5	168.40 ± 4.32	15	13	49	(26?)	170.25 ± 4.32
	L	13	11	45	25.5	168.40 ± 4.32	(12)	(10)	(44)	-	-
Femur	R	22	26	79	-	-	(24)	(26)	(83)	-	-
	L	21	26	78	-	-	(24)	(26)	(80)	-	-
Tibia	R	20	27	78	34	164.30 ± 3.37	(20)	(30)	(80)	-	
	L	19	28	77	34.5	165.56 ± 3.37	(17)	(30)	(80)	(37)	171.86 ± 3.37
Fibula	R	12	15	42	(34)	162.90 ± 3.29	-	-	-	-	-
	L	13	16	45	34	162.90 ± 3.29	-	-	-	-	-
Average height						166.86					169.34

M- L: medio-lateral; A- P: anterior-posterior

Dental attrition

Maxillary dentition LC, RLPm1, RLPm2 shows grade 5, RLM1 and RM2 shows grade 6 and LM2 shows grade 8 wear pattern. In mandible RI1, RLI2, RLC, RLPm1 and RLPm2 indicate grade 5 and RM1 7 and LM1 of 6 grades and RLM2 of grade 8 and RLM3 of grade 6.

Carries infection

A probable case of occlusal carries is seen on the mandibular RM3. There is a depression in the middle of the crown. All teeth show moderate amount of tartar accumulation, and almost all the roots are exposed.

Conclusion

The skeletal material from Leshemi, provides valuable information. However, it is insufficient for understanding health patterns at the population level. The pathological findings are important. The mandibular lesion (Fig. 7) throws light on bone modification due to habitual activity. The lesion seen on the first toe phalange requires further research for understanding the aetiology. The extra root in mandibular molars in the Jotsoma and this site is interesting to note. It may be isolated individual traits but provides scope for comparison of populations on the basis of morphological features.

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Table 5: Odontometric data of Gr. 1 and Gr. 2

Tooth	Side	MD	BL	CA	CI	CM
Gr. 1						
Maxilla						
Pm2	R	6.67	8.48	56.56	78.65	7.57
	L	6.65	8.50	56.52	78.23	7.57
M1	R	10.78	10.20	109.95	105.68	10.49
	L	10.78	10.27	110.71	104.96	10.52
M2	L	8.93	10.03	89.56	89.03	9.48
Mandible						
Pm1	R	6.85	6.69	45.82	102.39	6.77
	L	6.80	6.66	45.28	102.10	6.73
Pm2	R	7.16	7.07	50.62	101.27	7.11
	L	7.16	7.04	50.40	101.70	7.10
M1	R	11.00	10.57	116.27	104.06	10.78
	L	(10.99)	10.48	115.17	104.86	10.73
M2	R	10.79	9.52	102.72	113.34	10.15
	L	10.81	9.42	101.83	114.75	10.11
M3	R	10.54	8.87	93.48	118.82	9.70
	L	10.84	8.94	96.90	121.25	9.89
Gr. 2 Maxilla						
C	L	7.27	7.76	56.41	93.68	7.51
Pm1	R	7.42	9.65	71.60	76.89	8.53
	L	7.48	9.58	71.65	78.07	8.53
Pm2	R	6.67	9.65	64.36	69.11	8.16
	L	6.72	9.56	64.24	70.29	8.14
M1	R	10.97	11.14	122.20	98.47	11.05
	L	10.79	(11.13)	120.09	96.94	10.96
M2	R	9.89	10.91	107.89	90.65	10.40
	L	9.80	10.96	107.40	89.41	10.38
Mandible						
I1	R	(4.38)	5.20	22.77	84.23	4.79
I2	R	6.05	5.63	34.06	107.46	5.84
	L	5.43	5.10	27.69	106.47	5.26
C	R	7.80	6.09	47.50	128.07	6.94
	L	7.53	6.08	45.78	123.84	6.80
Pm1	R	7.37	7.74	57.04	95.21	7.55
Pm2	R	7.32	8.30	60.75	88.19	7.81
	L	7.33	8.32	60.98	88.10	7.82
M1	R	11.68	11.00	128.48	106.18	11.34
	L	(11.37)	(10.94)	124.38	103.93	11.15
M2	R	10.66	10.34	110.22	103.09	10.50
	L	10.71	10.52	112.66	101.80	10.61
M3	R	10.12	10.32	104.43	98.06	10.22
	L	9.97	10.24	102.09	97.36	10.10

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Shaikh Z A., *et al.*, *Man and Environment* XXXVI(1) 79-87 [2011].
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Study of Traditional Boats of Goa

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Abstract

Folk songs of Goa frequently mention 'Vodem' which denotes a canoe. The present paper discusses traditional boats of Goa, namely dugouts, extended dugouts with and without outrigger and plank-built boats, and stages in boat-building. A recent discovery of stone panels with a boat (canoe) motif is interesting in this context.

ntroduction

tudies of traditional boats provide information r reconstructing their history. European scholars ke Hornell (1920), Blue (1997) and McGrail 996, 2003, 2004) have studied traditional boats of ıdia, in general, whereas Indian scholars focussed n regional studies - Orissa (Sila Tripati 1995), ndhra Pradesh (Thivakaran and Rajamanickam 993), Tamil Nadu (Rajamanickam and Arulraj 991), Andaman and Nicobar (Rajamanickam and hivakaran 1992), Lakshadweep (Varadarajan 998, Tripathi 1993), Kerala (Greeshmalatha and ajamanickam 1993), Karnataka (Swamy 1994, 999; Gaur 1993; Sundaresh 1993), and Maharashtra ain 1993). Hornell (1920) referred to the *Rampon* pe of boat of Goa and Apte (1973) described boats f the Konkan coast, in which boats from Goa have een illustrated. Shaikh (2009) conducted preliminary udies regarding the growth and development of oat building in Goa. Boats portrayed on hero stones om Old Goa were studied by Rajagopalan (1987); ila Tripati (2006); and Sabnis (2008). Recently one panels with boat motives were discovered from arious parts of Goa (Gaur and Kerkar 2007; Kamat 008).

lassification and Distribution

raditional boats of Goa are classified into ur categories (Table 1) taking into account ajamanickam's (2004) classification system. The abed topography plays a prominent role in the stribution of traditional watercraft (Fig. 1). Skin oats are found in rivers because of the calm water (Fig. 2, see on cover 3), but dugouts, and dugouts with outriggers are found mostly in rivers, tributaries, estuaries and all along the coastline. Extended dugouts without outriggers are found along the near shore zone, engaged in fishing (Fig.3). Extended dugouts with outriggers having 2/3 strakes dominate all along the Goa coast (Fig. 4-6, see on cover 3). Sewn plank boats in which sand is transported are found mostly along the interior rivers of Tiracol, Chapora and Amona (Fig. 7).

Raw Material and Stages of Boat Building

Boat building processes includes several stages:- selection, seasoning, cutting of timber, bending, planking, caulking, fastening and outside treatment. The traditional boats entirely depend on quality, size and buoyancy of timber. Usually straight timber (6-8 m in length) with a minimum diameter of 0.75 to 1.00 m is preferred. Generally mango (*mangifera indica*) and jackfruit (*Artocarpus integrifolia*) timber are chosen for dugouts; and *malat* (*Aganosma caryophyllata*) and *jambal* (*Sizyginm cumini*) for plank built boats. Bamboos, *bhendi* (*Thespetia populnea*) and other locally available timbers are used for making the outrigger. Instead of using different types of timber, builders prefer a single type for the entire boat. Timber is seasoned in muddy water or in backwaters for 15 days or more, and then dried in the shade without exposing them to direct sunlight. This treatment enhances its resistance against woodborers, makes it stronger and simplifies scooping.

Planking, Joining, Bending and Fastening

The height of traditional boats is extended by adding a row of planks one above the other. In extended dugouts a row of planks is added to the dugout. In the case of plank-built boats, a row of planks is added to

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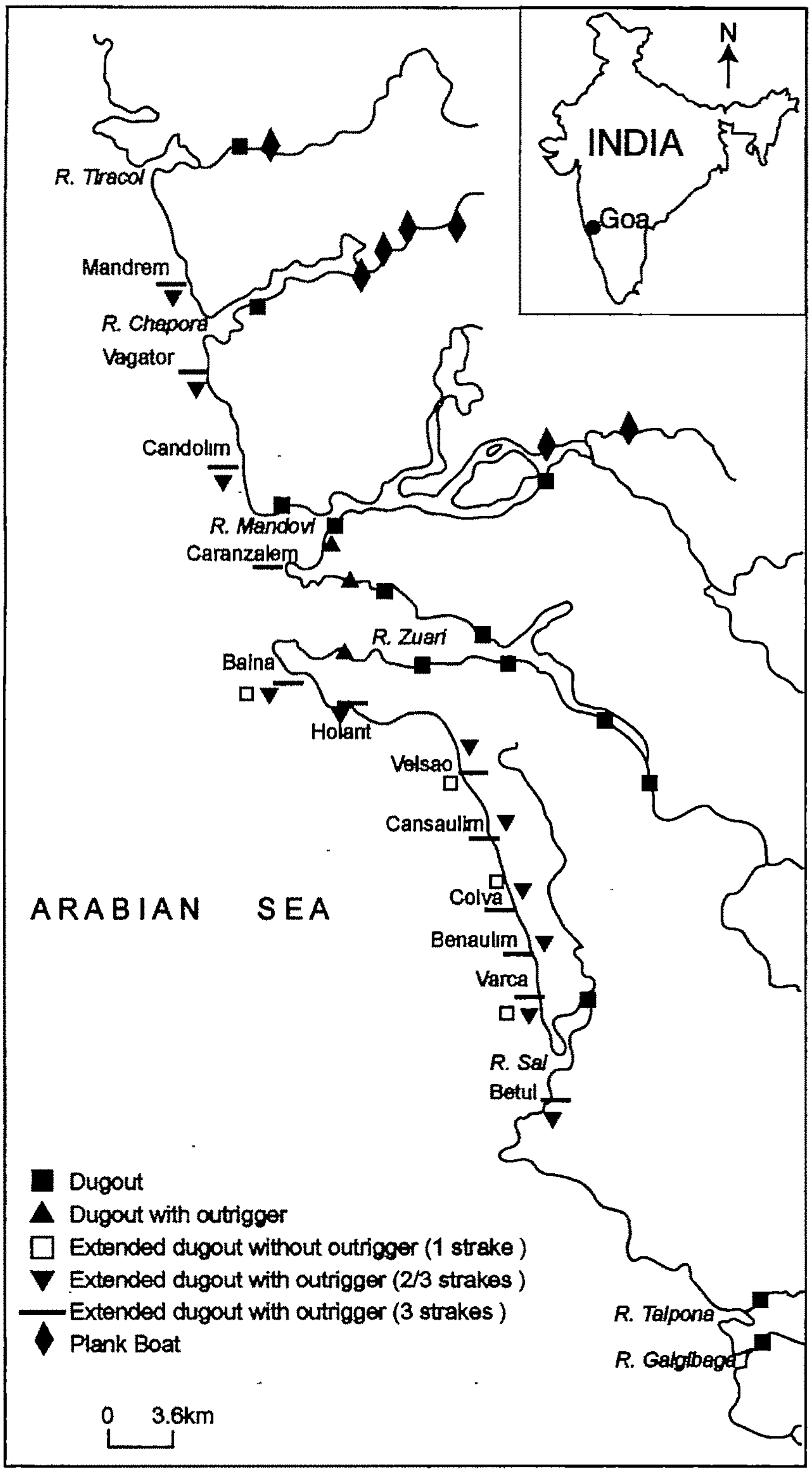
N
INDIA
Goa
R. Tiracol
Mandrem
R. Chapora
Vagator
Candolim
R. Mandovi
Caranzalem
R. Zuari
Baina
Holant
Velsao
Cansaulim
Colva
Benaulim
Varca
R. Sal
Betul
ARABIAN SEA
R. Talpona
R. Galgibaga
■ Dugout
▲ Dugout with outrigger
☐ Extended dugout without outrigger (1 strake)
▼ Extended dugout with outrigger (2/3 strakes)
— Extended dugout with outrigger (3 strakes)
◆ Plank Boat
0 3.6km

Fig. 1. Map showing distribution of traditional boats in Goa

the keel. This is followed by adding upper rows of planks, one above the other. The edges of the planks are joined with a '/' shape cut, whereas the planks are joined either with 'V' grooves or 'L' angle-joints. Male and female 'V' grooves are made on either plank and then joined. Such joints provide greater strength to planks and the chances of detachment ar minimal. Damaged portions are replaced with new timber (Fig. 8). The damaged portion of the boat is removed. A female 'L' shaped angle is incised on the edge of the plank, followed by a male 'L' shape angle, and the two are then joined together. Gunwal

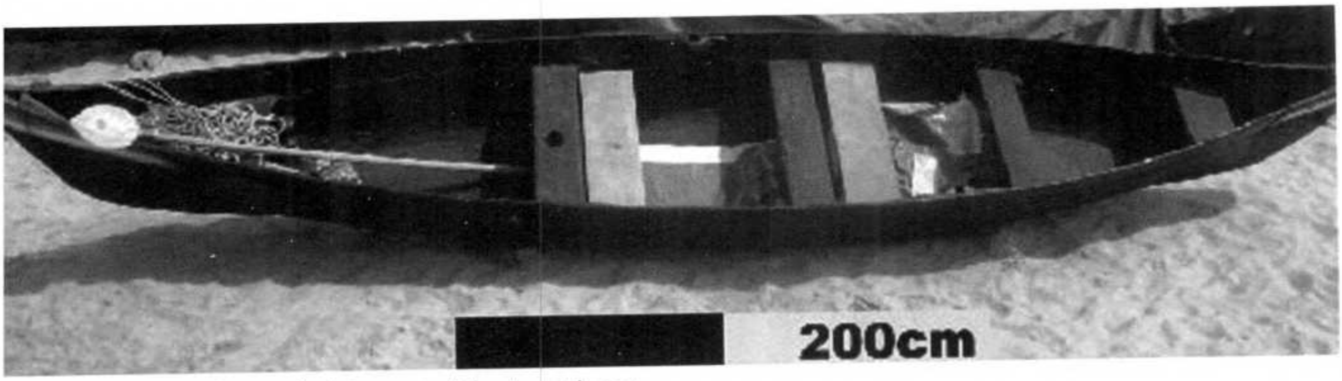

Fig. 3. Top view of extended dugout without outrigger

planks (locally called '*pakhi*') are curved, and added at the bow, middle and stern of the boat. In order to get a better bending of the plank - *kadu* oil is applied on either side and heated at low temperatures until the required bend is achieved. It is then fitted at the appropriate position on the boat.

Wooden pegs, coir, coir rope, nylon rope, copper nails, stainless steel nuts and bolts are used for fastening. A special variety of copper nails called 'rabbets' are used for fastening the ribs. Cracks in the plank are secured with small, thin copper nails. The stern is fastened with copper rods, nuts, nylon rope, and wooden pegs, and sometimes with stainless steel bolts. The damaged or woodborer-affected planks are replaced with new timber and fastened with rabbets and washers. In addition to cautious fastening, sewing is carried out to avoid detachment of planks. Sewing of pivots is done with coir. Sewing is carried out by two persons. A person sits inside the boat and passes the rope to another person sitting outside through holes. The rope is pulled tightly with the help of a wooden stick by another individual who sits on the outside. The sewing appears as 'X' or '└─┐' in shape.

Caulking and Coating

Caulking is applied on traditional boats to prevent water seepage and leakage. Caulking is carried out while planking and after planking with '*cari*', *tar* and cotton (Fig. 9). '*Cari*' is a type of glue prepared by local carpenters. Prior to joining planks, '*cari*' is applied on the edges of planks and cotton is placed over it. The planks are sewed at a later stage. '*Dig*', the coating material, is applied for caulking of traditional boats. It provides additional strength and durability, it protects from woodborers and enhances the longevity of the boat. '*Dig*' is applied both inside and outside the boat wherever required. As a part of the caulking, wooden nails are immersed in the '*dig*' then inserted into holes made for sewing. If any holes or cracks are noticed, those are filled with '*lambi*' that is a mixture of '*cari*' and '*chunnam*' (calcium carbonate) made by local carpenters.

Boat Building Techniques

The *Kharvi* community of Goa is engaged in construction of traditional boats, their maintenance and in fishing. After the Portuguese conquest of Goa in A.D. 1510, a large number of the *Kharvi* 's were converted to Christianity (Pereira 2008). Presently, both the Hindu and Christian *Kharvis* reside along the coastal belt and continue their traditional profession. People of other communities are not involved in building traditional boats. Traditional boat building technology is closely associated with inherited knowledge of the local carpenters. Most boats are built in temporary boat building yards near the beach or river banks.

Dugouts without and with outriggers

Dugouts are variously known as '*ponjal*', '*ponyao*', and '*vodem*' and are built from a single log. Most dugouts are made of mango (*mangifera indica*) wood. A centre line is marked on the log, which helps to cut timber into the required shape and size. The log is submerged within backwaters for about a fortnight and then dried in the shade. When still wet, scooping is carried out with adzes, chisels and axes, and the required shape of the canoe can be obtained. Two to three persons are engaged in this task for 15-20 days. While scooping, uniform thickness is maintained, i.e. about 0.6 m thickness at the bottom, 0.7 m at the gunwale and at 0.4 m the starboard (Fig. 10). Such measurements are maintained with the help of a small stick. In certain cases ribs are provided in reserve. Thwarts are then added by lashing them on gunwales

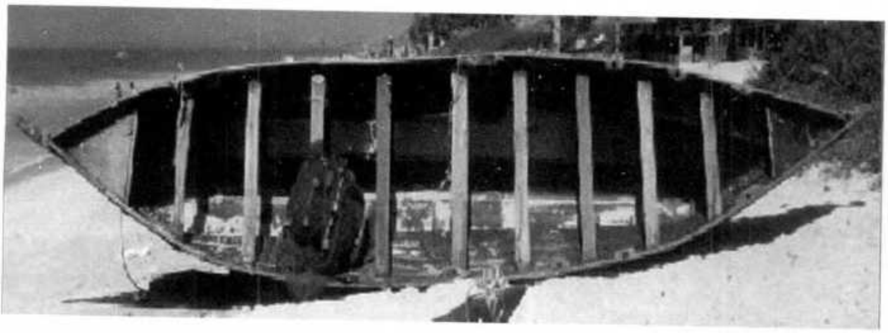

Fig. 6. Top view of extended dugout with outrigger (3 strakes)

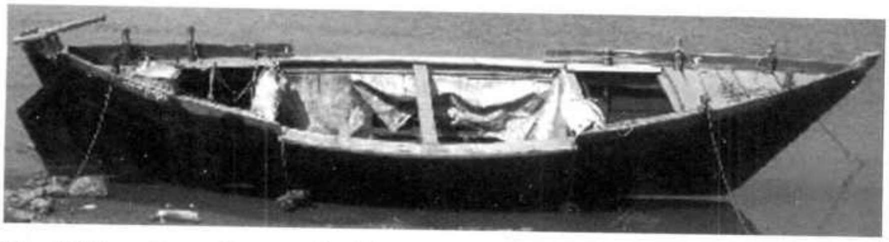

Fig. 7. Top view of sewn plank boat with keel

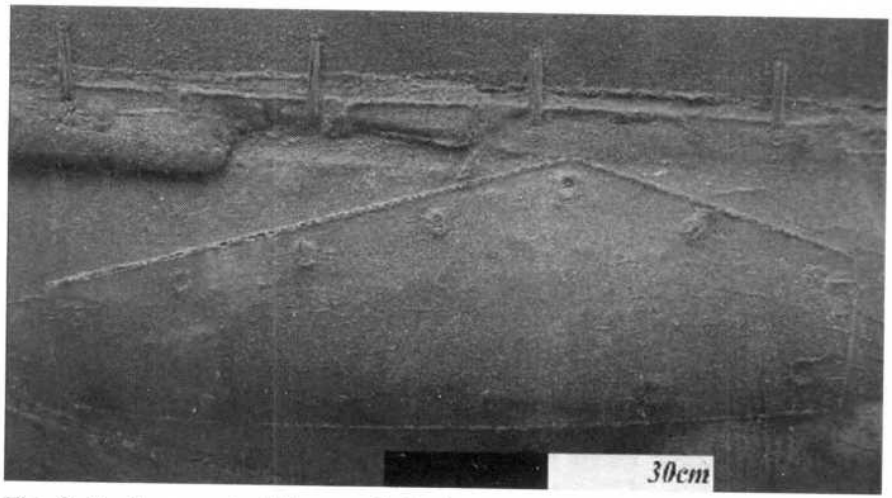

Fig. 8. Replacement of damaged plank

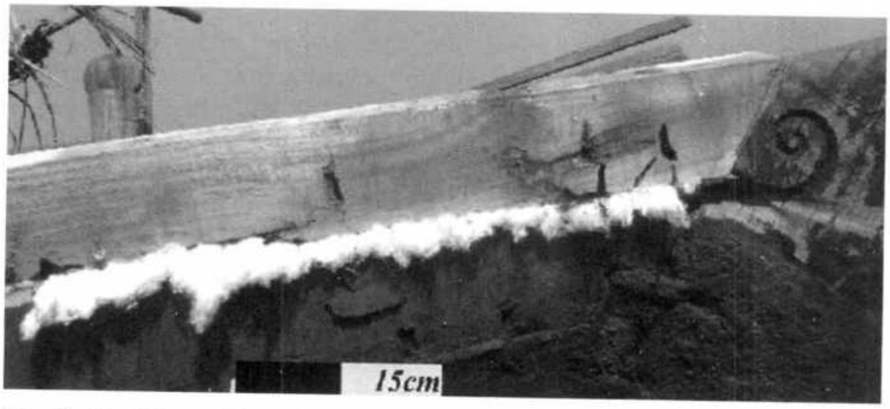

Fig. 9. Caulking of boat during planking

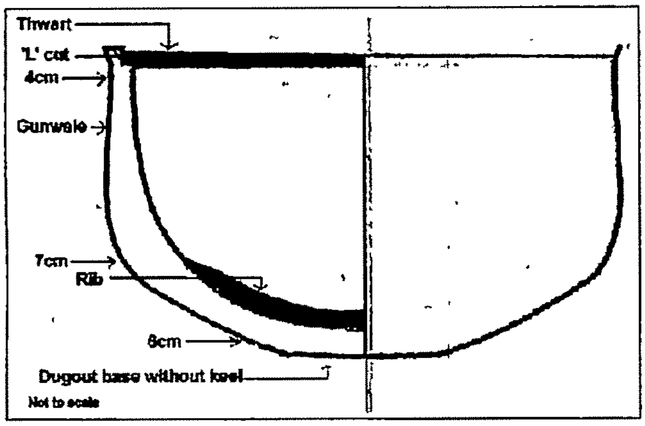

Fig. 10. Section showing the gunwale where thickness of timber increases at middle and reduces at top

either with coir or nylon rope. Thwarts are fixed to the dugout by making 'L' shape angles in the four corners in " ⊔ " shaped groove made on the gunwale plank (Fig. 11). Once the construction is completed, cashew oil (*'dig'*) is applied to the entire boat. Dugouts have a 'V' shaped vertical cross section at bow and stern whereas 'U' shaped vertical cross section in the middle. Simple dugouts are narrow and have limited lateral stability. In order to improve its lateral ability people use methods like heat expansion of the beam of the boat, stabilisers and outriggers, etc. (McGrail 1978). In Goa the outrigger is added to simple dugout whenever it is required.

Extended dugout

Extended dugouts are built by placing a row of planks (strakes) one above the other on the dugout. The extended dugouts played an important role in early periods in Indian and Indonesian waters (Johnstone 1988). There are three varieties of extended dugouts in Goa - extended dugout without outrigger having 1 strake, extended dugouts with outrigger having 2 or 3 strakes locally known as *hodi* or *vode*, and extended dugout with outrigger having 3 strakes locally known as *'Ramponachem vodem'* (*Rampon*).

Mango (*mangifera indica*) wood is largely used for construction of extended dugouts. Once the dugout is built, depending upon its type, rows of planks are provided edge to edge by providing a '/' shaped joint. For instance, in an extended dugout with one strake, one row of planks is added; similarly two to three rows of planks are added in extended dugouts with 2/3 strakes. The edges of the planks are attached precisely, leaving no chance of water leakage. Prior to joining planks *'cari'* (glue) is applied to the edges and cotton is smeared over it, following which planks are fixed. Holes are made at intervals of 0.6 to 0.8 m, on the planks and they are sewn with nylon ropes. The holes made for stitching are packed with wooden nails. Before packing, the wooden pegs are dipped into *'dig'*. The topmost plank at bow and stern in extended dugouts is known as *'khot'*. The bow *'khot'* is bigger than the stern *'khot'* to increase the height of the bow.

Once planks are added, 'U' shaped ribs made of single timber are fixed at regular intervals with copper rabbet inside the dugouts. In the case of extended dugouts with one strake, *hodi* ribs come up to half of the gunwales. In *rampon* the ribs are fitted at two places where outrigger posts are fastened. Ribs are made of single piece of timber in extended dugouts with one strake. In *hodi* and *rampon*, ribs are made of two pieces. Thwarts are added over the second last strake, i.e. just before the topmost strake is fitted. Thwarts provide horizontal support to the hull and prevent it from cracking. They are also used for seating. Lastly the keel is added to the dugouts. The keel is prominent at the base and merges with the bow and stern in extended dugouts with one strake and in *hodi*. In case of *rampon*, the keel is made of three pieces of timber and joined together. The bow and stern keel are fastened by making a 'V' groove and then sewed with coir. Whenever the keel is made of two timbers, it is joined together by making male and female 'V' grooves. No outrigger is provided in extended dugouts with one strake but the outrigger is added in *hodi* and *rampon*. After completion of the entire construction, cashew oil is applied to protect it from woodborers.

Sewn plank boat with keel

A few studies were done on the sewn plank boats of Bangladesh, India, Pakistan and Sri Lanka (Edye 1834; Hornell 1920, 1926, 1946; Greenhill 1971; Chittick 1980; Kentley 1985, 1993). Sewn plank boats of Goa are made of *'Malat'* (*Aganosma caryophyllata*) wood which is believed to be more durable in riverine conditions. These boats, locally known as *'Revechem hode'*, are engaged largely for transporting sand. Two to four persons are involved in construction of these boats and it takes almost 1½ or 2 months. The keel is laid first which is made of three pieces of timber (main or middle keel, bow keel and stern keel). The stern and bow keel are joined with main keel with ' ' groove (Fig. 12). After the laying of the keel 6 to 8 rows of planks are added on

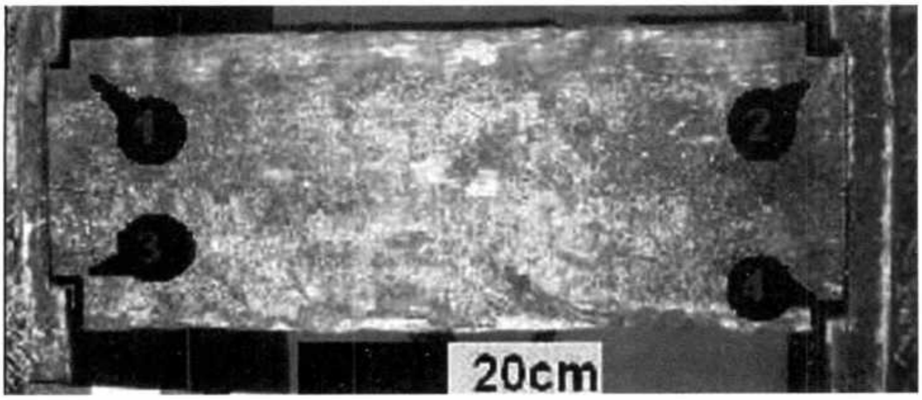

Fig. 11. 'L' shaped angle on four corners of thwart

either side one above the other in such a way that the vertical section in the middle becomes 'U' shaped whereas the bow and stern look 'V' shaped. Ribs are then added by making male and female shape '>' groove joints or 'L' shaped male and female grooves. Ribs are fixed at about 1 m distance and fastened with coir rope. Thwarts are added with coir rope at varied intervals. The available space between bow and first thwart and stern and last thwart is used as a deck. In the middle an iron rod is provided horizontally for strengthening the boat and to prevent damage or cracking. Cashew oil is applied to the entire boat as a preservative coat after construction.

Skin boats

These boats are found more in southern India and are called *parical* or *paricu* in Tamil and *harigolu* or *butti* in Kannada (Deloche 1994; Swamy 1999; McGrail 2003). Skin boats or hide boats, locally known as '*Harigolu*' or *butti* are made of bamboo strips. Bamboo strips are lashed together like a basket and their sizes are 0.30 to 0.40 m in height and 1.5 to 2 m in circumference. In appearance they look like a wide circular basket. These are suitable only to use in calm water particularly in lakes and rivers. A coat of '*tar*' is applied at their base to prevent water seepage. Presently, some use polythene sheets and apply *tar* to check water seepage. The fishermen of Karnataka use these boats in Goa waters. However, these boats are neither used nor constructed by Goan fishermen.

Gear and propulsion of boats

Skin boats are propelled by paddles and simple dugouts are operated with oars. The requirement of oars depends upon the size of dugouts. Extended dugouts with one strake are propelled by oars. Sometimes rudder and the sail are fitted. *Hodis* are propelled by oars and an outboard engine. Oars are used for propelling *Rampon,* but for long distance fishing, rudders and outboard engines are used. Plank boats are operated with long bamboo (poles) and a rudder. Neither oars nor outboard engines are used for these boats.

Sail and anchor

Extended dugouts with one strake occasionally use sails. The sail is made of a coarse cloth locally called '*cori elephat*' and they are rectangular. Locally available bamboo or timber are used as masts and yards. Local cotton ropes called '*beed*' are used for tying the sail, now replaced with nylon ropes. Stone and iron anchors (*Nangor* or *Nangar*) are used. Round and irregular shaped stones are used as anchors in dugouts and five fluked iron anchors are used in plank boats. The weight and size of the anchors depends on the size and capacity of boats. Anchors are used while fishing, loading and unloading of cargo and in case of emergencies.

Utility of Boats and Nature of Fishing

Dugouts of all varieties are used for fishing. Sometimes small-sized dugouts are engaged for ferrying. Dugouts, and dugouts with outriggers, are mainly used in calm water of 5-8 m depth. Presently, extended dugouts attach outboard engines and travel up to 45 to 50 km away from the shore. *Rampon* boats have oars and are used in near shore zones at about 8-12 m water depth. Plank built boats are utilised in transporting sand from rivers to hinterlands.

Local fishermen along the Goa coast use a particular type of boat for a specific types of fishing. Fishing is carried out with *hodis* for mackerel and

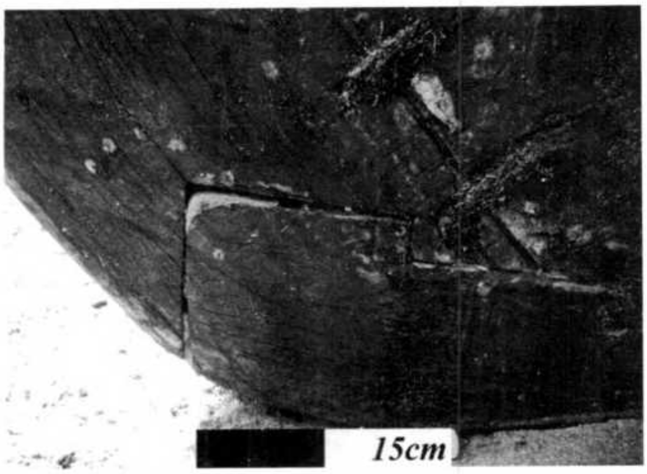

Fig. 12. Keel joined with ‘ ’ groove in plank boat

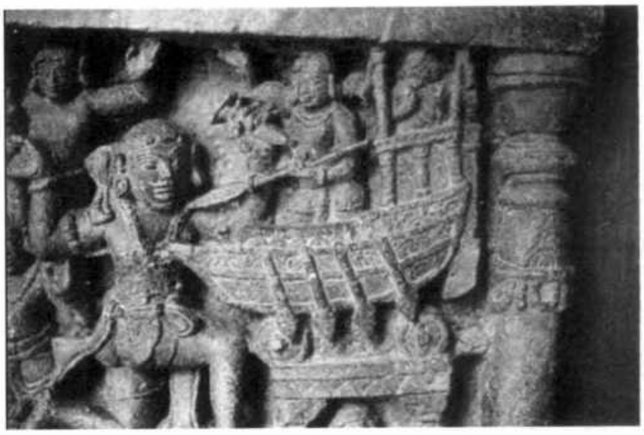

Fig. 13. Hero stone depicting sewn boat which is similar to present day plank built and *Rampon* boats of Goa

other fish (*Round mag*). In *Rampon* fishing, an important activity in the Goan society, a long net is dropped in semicircular fashion and about 24 *ramponkars* (fishermen engaged in such fishing) haul the net from the sea for a good catch.

Discussion and Conclusion

Different types of traditional boats are found along the Goa coast, but dugouts are predominant. Although dugouts and extended dugouts are similar in appearance and construction, there are some differences. The dugout with an outrigger is an additional attachment which provides stability, better maneuverability and utility. Outriggers are fixed once the dugouts are used in the sea, because they require greater stability. Dugouts with an outrigger are used in estuaries and in the near shore zone; whereas dugouts without outriggers are used in rivers and shallow waters where water is very calm. There is a structural difference between a *hodi* and a *rampon*. In the *hodi* two rows of planks are provided whereas three rows of planks are fitted in the *rampon*. The *rampon* is also wider than the *hodi*. There is a difference in the method of joining bow and stern planks in these two varieties. Bow and stern planks are interlocked and fastened with rabbets in the *hodi*, whereas in case of the *rampon* planks are joined and sewed with coir or nylon rope. The centre portion of the dugout is ‘U’ shaped while the bow and stern is ‘V’ shaped.

Traditional boats of Goa have been designed in accordance with the seabed topography of Goa. For instance ‘*Rampon*’ boats are used off straight sandy beaches and these boats have a large distribution in Goa as compared to other boat types, because of the nature of these sandy beaches. Amongst the boats, the ‘*Rampon*’ is unique in the history of boatbuilding technology of Goa. Similar boats are depicted on hero stones displayed in the Archaeological Museum (ASI), Old Goa and on recently discovered stone panels in the Sattari taluka of North Goa District (Gaur and Kerkar 2007). The sewing pattern plank built and *rampon* boats are similar to those shown in one of the hero stones, displayed in the ASI Museum, Old Goa, which portray naval warfare (Fig. 13). The sternpost rudder is also similar to that of plank boats. Triangular oars are also depicted on hero stones and are also similar to oars used in *rampon* and dugouts. The canoe type of crafts shown in hero stones (Sila Tripati 2006) can be correlated with dugouts of Goa. Likewise the stone panel discovered from Nagve, located on the tributary of the river Mahadei, in Sattari taluka, depicts a boat motif which has four grooves on the outer surface and resembles the plank built boat (Gaur and Kerkar 2007).

With the exception of minor differences, related to the joining of planks such as ‘V’ and ‘L’ groove, no major changes were observed in the construction of boat building techniques of Goa and Karnataka. Detailed studies of traditional boats in Maharashtra and Gujarat are essential for comparing these with boats in Goa and other parts of India. Skin boats which are used by people of Karnataka in Goa waters have had no impact on the boat building technology of Goa.

The study of traditional boats has brought to light new information from Goa. Despite advancement in technology, traditional boat builders have retained their inherited knowledge which passes from father to son. Boat building centres of Goa have been noticed

Table 1 Classification and distribution of traditional boats along Goa coast

Type of boat	Local term(s)	Boat building centres	Carrying capacity in tonne	Purpose
Dugout		Betim, Katem Baina, Betul, Benaulim		
Dugout Without outrigger	*Ponjal / hodi/ponyao/ Vodem*		0.15-0.20	Inland fishing
Dugout With outrigger	*Ponyao / hodi / Vodem*		0.20 - 0.25	Inland and offshore fishing
Extended Dugout		Betim, Katem Baina, Betul, Benaulim		
Extended Dugout Without outrigger	*Hodi / Vodem*		0.50	Offshore fishing (long distance)
Extended Dugout With outrigger (2/3 strakes)	*Hodi / Vodem*		1-1.5	Offshore fishing (long distance)
Extended Dugout With outrigger (3 strakes)	*Ramponchi hodi / Vodem (Rampon)*		2 or 2.5	Offshore fishing (short distance)
Sewn Plank Boat with keel	*Revechem hode*	Tiracol, Chapora, Amona	10 to 12	Removal of sand from river bed
Skin boat		Karnataka		Inland fishing

along the coastline and riversides, but their number is falling because of changes in raw material and construction technology.

Acknowledgements
The authors thank the Directors of NIO, Goa, and Deccan College Postgraduate and Research Institute, Pune, and K.H. Vora, Scientist-in-charge, Marine Archaeology Centre, for their encouragement. Special thanks go to traditional boat builders and fishermen of Goa who have provided valuable information. This is NIO's contribution No. 4996.

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Vinod V. and Krishnan K., *Man and Environment* XXXVI(1): 88-91 [2011].
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Potting Skills: An Ethnographic Perspective

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Abstract

This paper documents the skill of potters from five workshops in the region around Bagasara and reflects upon the notion of specialization. Variations in attributes are measured using morphometric methods. Variables considered for the analysis are the height, thickness and diameter of the vessels. The paper further discusses the skill of the potters, specialization and the notions of standardization.

Introduction

This is an attempt to understand the relationship between skill and specialization through an ethnographic survey of pottery making units at five workshops located around Bagasara village (23° 3' 30" N; 70° 37' 10" E), where a Harappan site is located. This kind of survey is significant as it can lead to understanding and recording existing pottery techniques of the region with a view to generate data, which may further be used to evaluate the levels of specialization and standardization in existing pottery production units. Such an understanding might help address archaeological issue related to specialization and standardization.

The origin of craft activity, its organization and associated technologies are important aspects of archaeological research. Subsistence, specialized production, resource management and production of durable craft goods may be viewed as defining parameters of socio-political complexity. It may be argued that the process of urbanization or the different stages of development/change of a production system or organization can be best established by understanding the paradigm of craft specialization (Rice 1981a,b). Most archaeological studies attempt to identify increasing levels of craft specialization as an indicator of increasing social complexity.

The Harappan site at Bagasara is located on the eastern extremity of the Gulf of Kachchh in Malia Taluka, Rajkot District, Gujarat State. It is located very close to the coastline, at equal distance from Kachchh, North Gujarat, and Saurashtra, the three major geographic regions of Gujarat. Therefore, it shows the distinct cultural traits of the three Chalcolithic cultures of these regions. This unique geographical location of the site allows archaeologists to presume it as a hub through which Chalcolithic communities interacted.

Methods of study

The methods comprised recording all events in workshops through observation of activities and interviews of potters and their families, followed by photographic documentation of different stages of production. A morphometric analysis of the vessels from each workshop was carried out to understand the degree of variation reflected in them. This degree of variation is used as a measure of evaluating skill and degree of standardization. The easily recordable parameters: height, maximum internal diameter, maximum external diameter, rim diameter and rim thickness were considered for morphometric analyses. Its coefficient of deviation was calculated by taking of the ratio between Mean deviation and the Mean (Gupta 1969).

Coefficient of mean deviation

$$\text{C.M.D} = \frac{\text{Mean Deviation}}{\text{Mean}}$$

$$\text{Mean Deviation (M.D)} = \frac{\sum X - \bar{X}}{n}$$

Ethnographic Survey of Potters' Workshop

The surveyed workshops were labeled as W1 [(Bavpur Village) (Names of the potters: Amarshi Bai

Received : 11-01-2011
Revised : 18-04-2011
Accepted : 10-06-2011

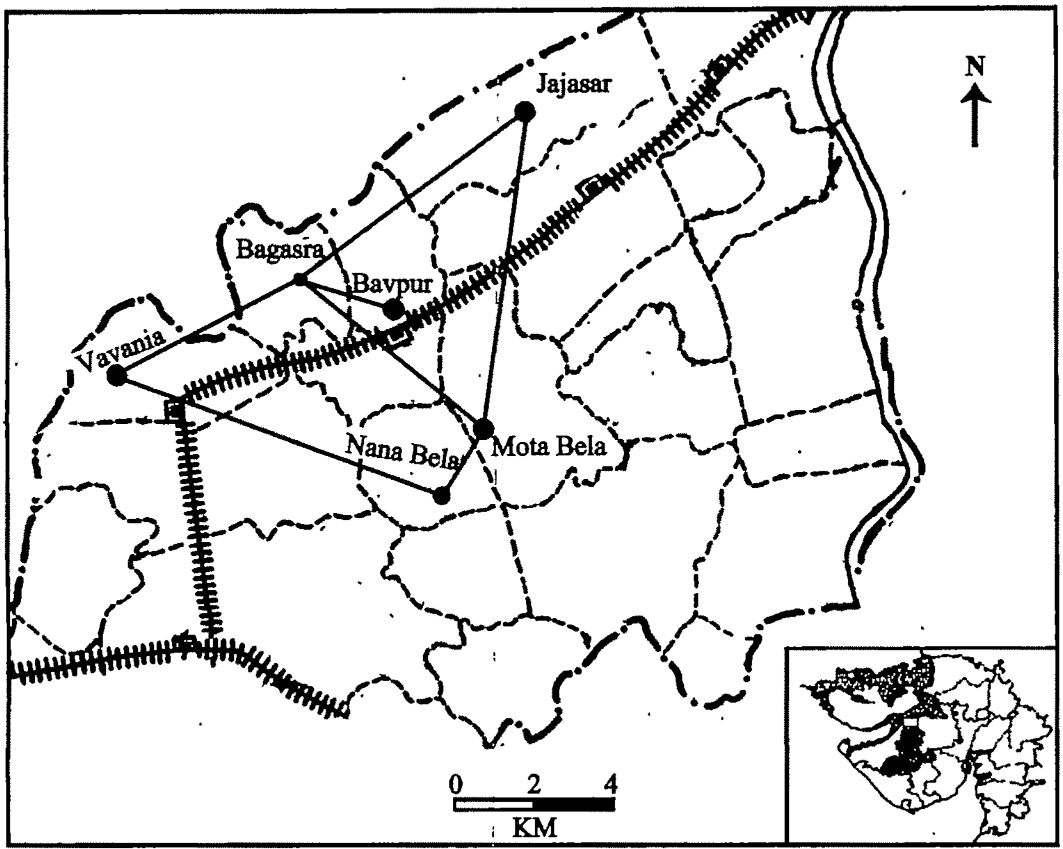

Fig. 1: Area under study and the location of the workshops

and Godawari Ben)], W2 [(Jajasar Village) (Names of the potters: Bikhi Bai and Godi Ben)], W3 [(Vavania Village) (Names of the potters: Mavji Bai and Leela Ben)], W4 [(Mota Bela Village) (Names of the potters: Laljibai Devkar)], and W5[(Nana Bela Village) (Names of the potters: Babu Bai and Rema Ben)]. Of these, potters at W1 use a mixture of clay from two localities, whilst at other workshops (W2, W3, W4, and W5) the potters use a mixture of clay from three localities. It was found that all potters exploit the local sources of clay; from the village lake, *dariya* (sea shore) and the surrounding forests. All members of the potters' family are actively involved in all the stages of production except at W2, where a division of labour exists within family members. Another additional trait of the workshop activities is that women do not throw vessels on the wheel, exceptions noted in the case of W3. W1, W2 and W3 have year round production, while W4 and W5 produce pots only for 3-4 months in a year. During the remaining period they practice agriculture, cattle breeding and brick manufacturing. The subsistence economy of W1 and W2 is completely derived from pottery production while other workshops depend on diverse means. Based on the period of time each workshop spends on pottery making, they may be categorized as part-time and full-time production units. Both full-time and part-time units produce vessels for varying functions. Common types are *gora*, (water storage), *bhamba, batak* (water bottle), *patia* (small basin for cooking vegetables), *ramayya* (lid), *kasrod* (frying pan) and tawa (making roti). Forms produced for other purpose are *kodia* (lamp), *galla* (piggy bank) and *pambodi* (flower pot). In addition to this, these potters produce a variety of other shapes according to societal needs.

Pottery Techniques

To begin with, potters collect clay from deposits occurring in the neighbourhood.. The raw material is refined through removal of chunks by hand. It is further processed by crushing with an appropriate tool, most common being a wooden piece, and it is then sieved. Once the clay is devoid of impurities, it is mixed with an adequate amount of water. It is then kneaded with hands and feet to form a smooth paste

Table 1 Variation on the samples in all workshops

Workshop and Potters	Age and potting experience in years	Source of Clay	Nature of Production	Variation in Percentage
Bavpur (W1) Amarshi Bhai and Godawari Ben	80 (70) 55 (45)	Village lake Forest around	Year round production	5.56
Bavpur (D)	Same as above and researcher as assistant	Same Source	Under consumer's demand	3.66
Jajasar (W2) Bikhi Bhai and Godi Ben Kirite Bhai Giridar Bhai	55 (50) 50 (40) 32 (25) 30 (23)	Village Lake, Dariya (sea shore) forest around.	Year round production	3.68
Vavania (W3) Mavji Bhai Leela Ben	65 (60) 50(40)	Village Lake, Dariya(sea shore) forest around.	Year round production	6.22
Mota Bela (W4) LaljiBhai Devkar Amrita Ben	60 (50) 52(45)	Village Lake, Dariya(sea shore) forest around.	Seasonal (3 to 4 months)	5.45
Nana Bela(5) Babu Bhai Rema Ben	50 (40) 45 (38)	Village Lake, Dariya (sea shore) forest around.	Seasonal (3 to 4 months)	5.71

Table 2: Potting variations in the workshops around Bagasara

	Bavpur W1	Bavpur W1 D	Jajasar W2	Vavania W3	Mota Bela W4	Nana Bela W5
Height	0.033	0.026	0.024	0.0389	0.0207	0.0313
Internal diameter	0.03	0.0285	0.023	0.0158	0.0306	0.0374
External diameter	0.04	0.025	0.0327	0.0167	0.0286	0.0301
Rim thickness	0.089	0.0732	0.0371	0.0974	0.0948	0.0618
Brim thickness	0.086	0.051	0.0684	0.1422	0.1007	0.1249

in which the distribution of non-plastic inclusions become even. Occasionally, ash or cow dung are also used by the potters to increase its workability. The processed clay is shaped into a *pinda* (heap of clay with a tapering shape), which is ready to be thrown as a vessel on a wheel. Once the pot is shaped it is detached from the wheel using a thread. The rim shape is defined using a piece of wet cloth or polished wood or bone. The detached pots are kept in the shade to dry. Once the pot attains a leather-hard state it is enlarged to the desired size by beating and turning with dabber and paddle. Once the pots are enlarged, their surfaces are smoothened, after which the paddle marks disappear. Occasionally a slip is applied. The dried pots are arranged in an open-fire baking kiln and fired overnight. The fuel generally comprises small pieces of wood and cow-dung cakes. In the post-firing stage, the vessels are decorated by executing designs with colours. The marketing of pots is done either at the potter's residence or at a common place.

As one of the objectives of the work was to examine if there was any variation in the selected parameters of the vessels produced by full-time and part-time production units, a metric analysis was carried out on the products of these workshops. The results of this were used to evaluate the degree of skill and levels of specialization.

Metric Analysis

Hypothetically, one may assume that the products manufactured by a full-time potter would be comparatively superior to that of a part-time potter. It was thought that the metric analysis of the finished produce would yield results to either support or refute the aforesaid assumption (Fig. 2).

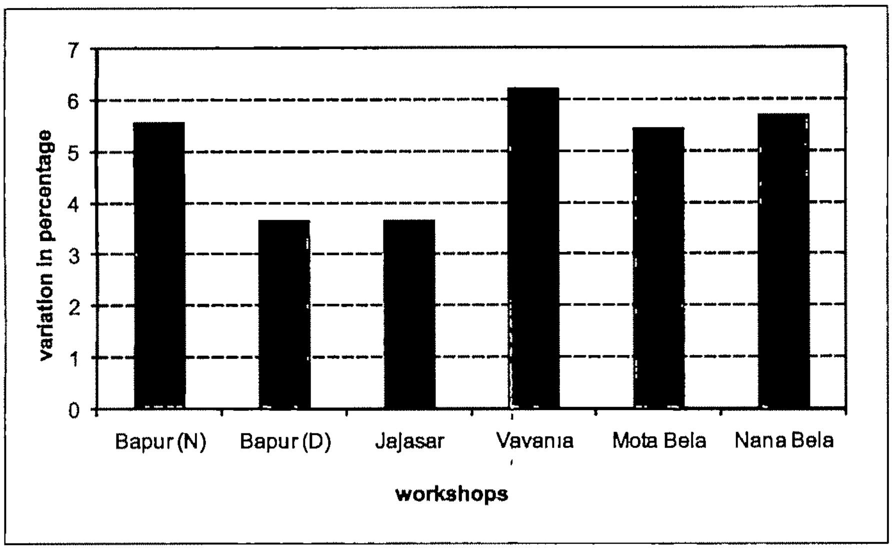

Fig. 2. Chart showing the summary of the variation occurred on the samples analyzed on all the workshops

During the process 25 samples of each shape were selected from each workshop for measurements. The coefficient of deviation of the metric data thus generated is considered as a measure of dispersion. This method is commonly used to measure relative variation. Relative variation is used when one wants to compare the variability of two or more than two groups. If the coefficient of variation is high then the properties of the group vary greatly revealing a direct relationship between properties of the group and its coefficient of deviation.

Discussion

The analysis brings interesting finds and opens avenues of discussion. From Table 2, it appears that products from workshops W4 and W5 have less variation than those from W3 and W1. The irony is that W4 and W5 are part-time potters as compared with while W2, W3 and W1 . Samples from W1D were excluded from the analysis as they were produced to meet specific demands of consumers. It was observed that ceramics produced by W2 where division of labour is practiced, exhibits a high degree of uniformity in comparison to the products from other workshops. Does this 'uniformity' mean 'specialization'? It could be true in this particular scenario; however, it needs to be debated if 'uniformity' and 'specialization' are the same. These need not be the same always, as there could be timely adaptations from the potters' side to improve the attributes of their products so as to make them appear uniform. This method of 'false standardization' is often viewed as a criteria to evaluate specialization. Another noteworthy feature is the tendency of the potters to switch over to different working patterns as per the seasonal changes. This would enable them to reduce damages and maximize human labour.

There has been a general tendency among archaeologists to view full-time potters as being more specialized than part-time potters. The present study rules this out to a great extent and suggests that it has more to do with skill, use of raw material, processing techniques and seasonal adaptations of the potters that leads to specialization.

Acknowledgements

The authors would like to acknowledge the village potters for their kind cooperation during this study. We also thank Mr. Vrushab Mahesh and Ms. Oishi Roy for going through the manuscript.

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Menon S.M., *et. al., Man and Environment* XXXVI(1): 92-95 [2011].
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New Discoveries of Stone Alignment and Megalithic Burials in Karnataka

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Abstract

This short communication describes two hitherto unreported megalithic sites in Karnataka, discovered during exploration. One of the sites is at the village of Chikel Chetti, near Bandipur Wildlife Sanctuary. This site consists of 5 exposed cist burials and 5 undisturbed cairns. The second site is a stone alignment at Aaraga Gate near Tirthahalli. Eight surviving menhirs of the stone alignment were noted.

Cist Burials and Cairns near Bandipur, Karnataka

A hitherto unreported megalithic site (11° 39' 45" N; 76° 43' 19" E) was noted in July 2007, during the course of a visit to a private property near Bandipur in Karnataka, close to the border with Tamil Nadu (Fig. 1). The site was visited twice after that and a site plan prepared. The megaliths, located on private as well as government land, are in the village of Chikel Chetti, which may be reached by a mud road that diverts towards the left from the asphalt road leading from Bandipur Wildlife Sanctuary in the Chamarajnagar District of Karnataka towards Mudumalai Wildlife Sanctuary in Tamil Nadu.

The area where the megaliths are situated is a flat plain, with scrub forest nearby. There are low hills visible on the horizon. The megaliths, which consist of 5 exposed cists and 5 undisturbed cairns are located in a flat area roughly 100 m E-W and 150 m N-S. There is a hill to the north-west of these and a small excavated water body to the west of the megaliths. The local residents refer to the megaliths as *Cholara kallu* (lit. "The stones of the Cholas") and claim that some of the megaliths have disappeared over time. The megaliths are either exposed cist burials which are severely disturbed or cairns that are more or less intact (Fig. 2).

Cist Burials

The cists are made of granite slab orthostats, roughly 0.10 m thick, whose tops are visible above the ground level (Fig. 3). The cists, rectangular in shape, are rather small, with the length of the exposed orthostats above the ground varying from 0.33 to 1.42 m. Three of the cists have three orthostats surviving, one has two and one has only one left. Though it is difficult to say for sure with the scanty remnants, it does look that the orthostats were originally meant to interlock in the manner of the Brahmagiri cists (Wheeler 1948). The width of the space enclosed by the orthostats varied from 0.36 to 0.53 m. Two of the cists with three orthostats were oriented E-W (260° and 285°), with the other oriented N-S (303°).

The cists are obviously highly disturbed, with at least one orthostat missing from all and the contents of the chamber, if any, missing. It is highly likely that capstones were originally present, since two large slabs, some 20 cm thick, turned up during the excavation for the foundation of a building nearby. It is impossible to say if there were any portholes in any of the orthostats since none of the cists are intact.

Cairns

The area also has 5 large cairns of various diameters. The cairns are large heaps of stone rubble piled up in a roughly circular layout. The diameters of the cairns are 5.5 m, 6.4 m, 9.0 m, 9.3 m and 11.0 m. The largest cairn has stone slabs driven in on end around its diameter, presumably to contain the large heap of rubble that comprises the cairn. A large slab with chisel marks was found on one of the cairns (Fig. 4). However, the chisel marks could be of relatively recent date when someone could have removed a portion of the slab.

It is possible that the cairns enclose one or more cist burials beneath the ground. Only excavation can

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Received : 14-02-2011
Revised : 02-03-2011
Accepted : 28-04-2011

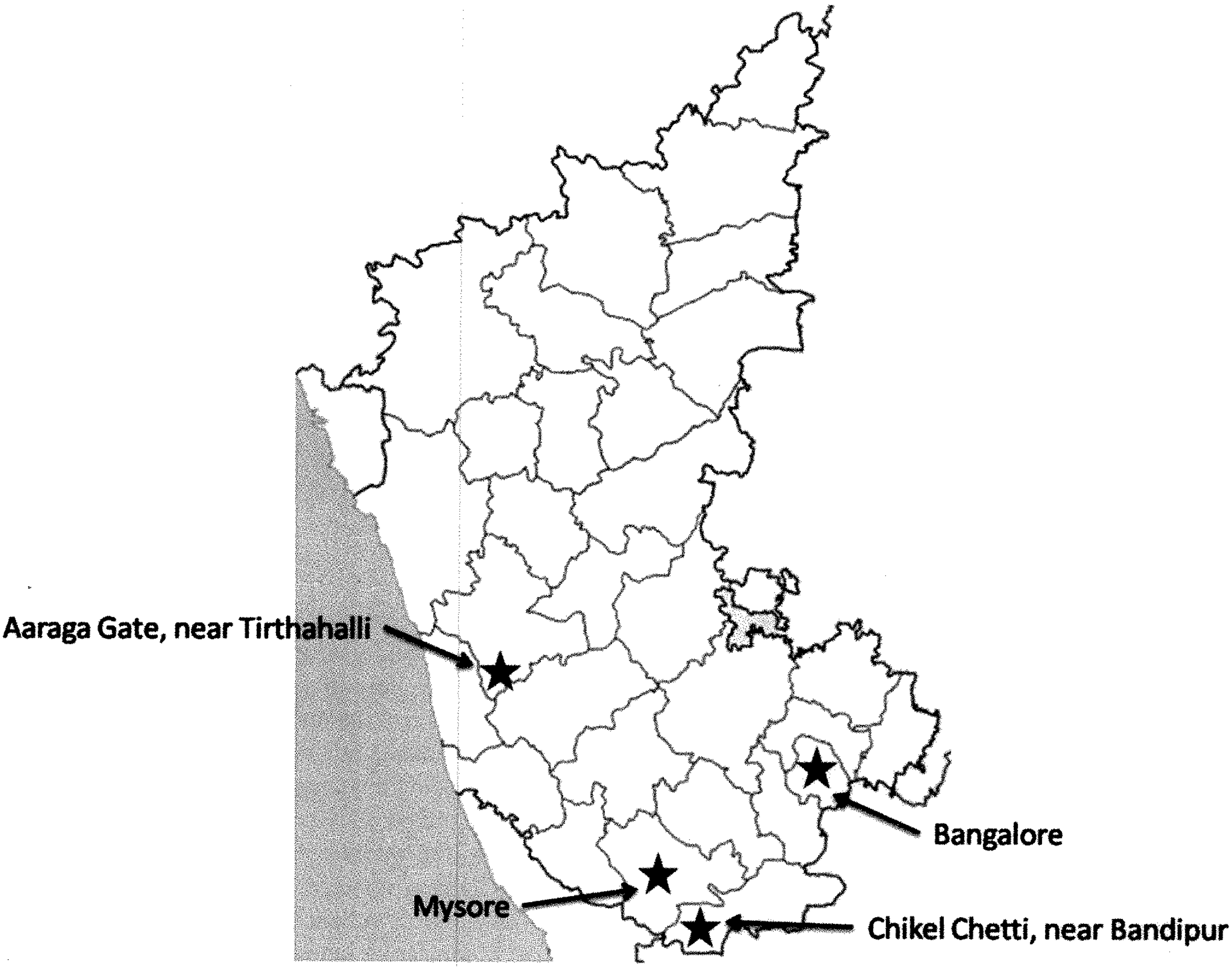

Fig. 1: The locations of the new megalithic sites in Karnataka

tell us about this. The cairns seem more or less intact and free from vandalism.

Stone Alignment near Aaraga Gate

The existence of menhir sites in southern Karnataka is well known. Sundara (1975) reports sites like Nilaskal (13° 46' 36" N; 75° 01' 09" E) near Hosanagara and Gudde Maradi (13° 54' 01"N; 75° 34' 25" E) near Shimoga. At a later date, he also reports the sites Byse (13° 49' 45" N; 75° 00' 43" E), Hergal (13° 52' 24" N; 75° 06' 3" E) and Mumbaru (13° 54' 43" N; 75° 07.47.3" E) in the Nilaskal region (Sundara 2004). As part of a project investigating megalithic monuments of south India for possible astronomical purpose in their design, the above-mentioned sites were visited regularly during the period 2007-2010.

No trace of the menhirs reported at Gudde Maradi during the visit in December 2008 could be found. All of these most probably have fallen victims to a granite crushing unit functioning nearby. It was noticed that the Nilaskal group of sites exhibits some common characteristics (Menon and Vahia 2010, 2010b in press). All four sites comprise menhirs with the long axes of their cross-sections aligned more or less north-south and at least at Baise and Nilaskal, pairs of menhirs frame the rising/setting sun on the two solstice days.

The New Site at Aaraga Gate

During the course of one exploration, an aged resident of Hosuru Village, near Agumbe, Mr. Dharmanna, mentioned the existence of a similar site at Aaraga Gate. During subsequent visit in December 2009 eight menhirs or the broken stumps of menhirs in an overgrown plantation adjacent to the road joining Tirthahalli to Nagara were found. Aaraga

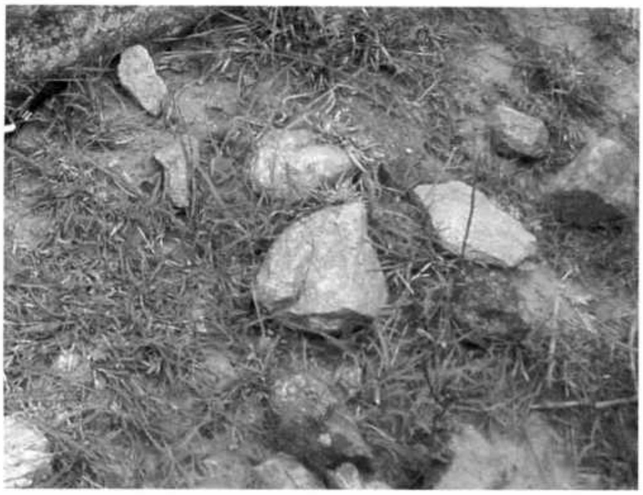

Fig. 2: One of the exposed cist burials at the site

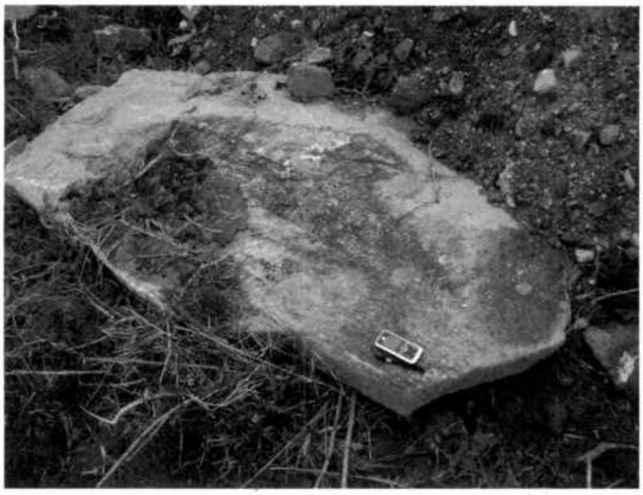

Fig. 3: A large slab, possibly a capstone of one of the cists, that was unearthed during excavation for a building foundation nearby

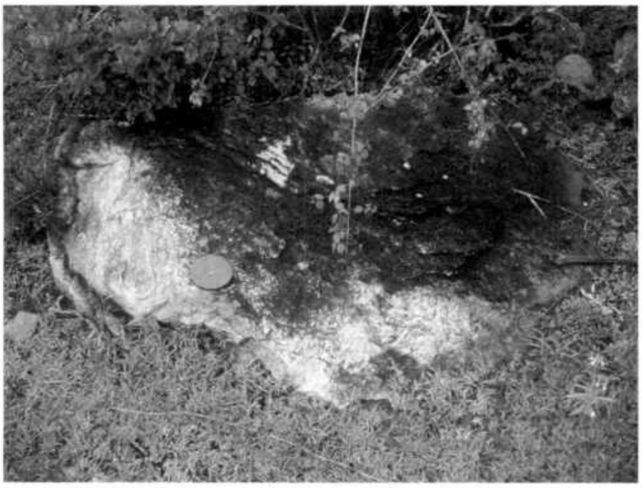

Fig. 4: A large slab with chisel marks found on one of the cairns

Gate (13° 44' 12.9" N; 75° 12' 38.7" E) is located 30 km along the road from the town of Nagara towards the town of Tirthahalli (Fig. 1).

All the eight menhirs are situated in a plantation spread over approximately 50 x 30 m. The topography is largely flat. The largest of the megaliths is a roughly hewn stone of rectangular cross-section, roughly 1.8 m high (Fig. 5). The rest of the stones seem to be the broken stumps of menhirs, each with more or less elongated cross-sections. They seem to be minimally dressed natural boulders, erected on their ends. All except one have their long axes aligned north-south. One of the stones is located at the edge of the existing road (Fig. 6). It is highly likely that many of the stones have been destroyed during the building of the road.

Conclusion

This is the first report of megalithic monuments from the Bandipur region, which is of interest since it is geographically close to the megalithic monuments of the Nilgiris and the plains of Tamilnadu and would offer interesting comparisons. Several of the cairns, including the largest one with the end slabs all around, are on government land and need to be protected from vandals, grave robbers and those looking for easy material for construction.

The stone alignment at Aaraga Gate is similar in design to the earlier known sites at Nilaskal, Baise, Hergal and Mumbaru nearby. Due to non-random nature of their layout, they deserve to be classified as a stone alignment rather than as haphazardly erected menhirs. Many single stones that fit the description of such menhirs at least at three locations were noticed (e.g. Fig. 7). It is possible that these stones are the sole survivors of similar stone alignments destroyed by road building activities.

Acknowledgements

We gratefully acknowledge the contribution and assistance of Mr. Santosh Kumar of Getoffurass Travels, Bangalore on site at Bandipur. His resolve to protect the megaliths within his property and activism to protect others on government land is laudable. We also acknowledge valuable contribution of Mr. Dharmanna of Hosuru Village in the discovery of the site at Aaraga Gate. We also wish to thank Dr. Sudhakara G. of Manipal Institute of Technology and Ms. Nisha Yadav of TIFR for discussions. We are grateful for financial assistance provided by the

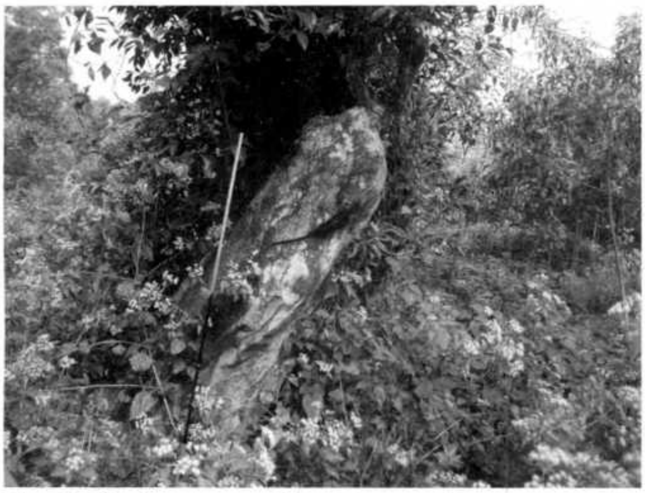

Fig. 5: The largest menhir at Aaraga Gate

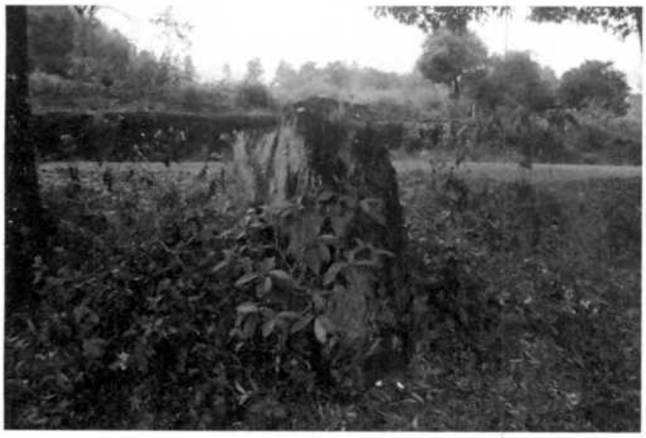

Fig. 6: One of the menhirs at Aaraga Gate right adjacent to the road

Prof. D. S. Achyutha Rao Memorial History Research Fellowship, Manipal University and the Jamsetji Tata Trust.

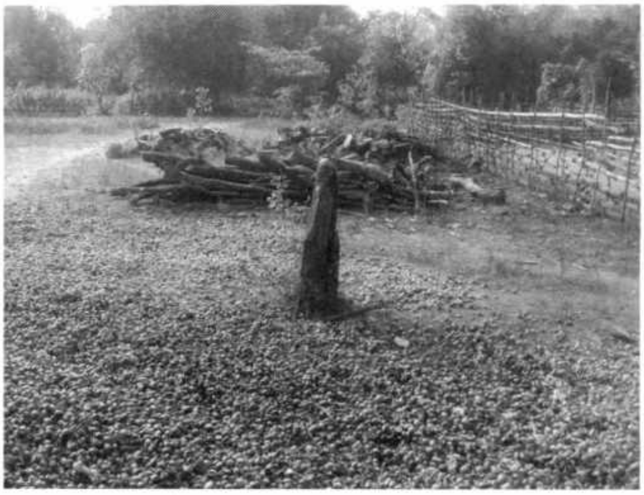

Fig. 7: One of the possible menhirs near the road to Aaraga Gate

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Paddayya, K., *Man and Environment* XXXVI(1): 96-116 [2011].
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An Estimate of Raymond Allchin's Contributions to South Asian Archaeology with Special Reference to Southern Deccan

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Abstract

This paper seeks to estimate the importance of Raymond Allchin's contribution to field archaeology in Southern Deccan, with special reference to his work on the Neolithic ashmounds published as a monograph entitled *Neolithic Cattle-Keepers of South India: A Study of the Deccan Ashmounds* (1963). Reference is then made to his work in Pakistan, Sri Lanka and other parts of South Asia and also to his various efforts to promote studies in the early history and archaeology of South Asia in Western Europe.

Introduction

From even a cursory glance at the progress of field studies in archaeology undertaken in Southern Deccan covering the Krishna and Tungabhadra valleys during the last one century and a half, two names among foreign workers stand out. One is Colonel Meadows Taylor who achieved distinction as an administrator attached to the staff of the British Resident at the princely state of the Nizam of Hyderabad. Taylor also earned for himself a permanent place in the history of Indian archaeology by virtue of his remarkable discoveries of Iron Age megalithic sites in the Shorapur principality in the 1840s. What is perhaps even more important, he prepared site maps giving basic measurements of the spots and number of grave monuments located on them and excavated a few of the stone circles at Jewargi on the Bhima river, for which purpose he adopted the stratigraphical method as a matter of common sense (Taylor 1941). Taylor thereby heralded the beginning of systematic field archaeology in India. Mortimer Wheeler (1961: 23) rightly called Taylor's achievements "a landmark in the annals of archaeology."

Exactly a century later Raymond Allchin, another British national, once again chose the lower part of Deccan for regular archaeological investigations and he too left a permanent imprint on Indian archaeology. Allchin, Emeritus Reader

in Indian Studies at the University of Cambridge, passed away at his home near Cambridge on 4 June 2010 at the advanced age of 87 years. In this paper I intend to highlight first the nature and significance of his archaeological studies in the Deccan and then present a brief review of his contributions to South Asian archaeology on the whole, of which he was an outstanding spokesman in the western world for half a century.

Archaeological Investigations in the Deccan

Doctoral Research

Raymond Allchin was born in Harrow, Middlesex, on 9 July 1923. He completed his school education at Durston House, Ealing, and Westminister School. From 1940 to 1943 he went to the Regent Street Polytechnic School of Architecture, London, and completed his First Degree in architecture. Then he was called for war services and was posted with the Royal Corps of Signals in Central India. He remained there for four years from 1944 to 1948.

This four-year stay in India proved to be a real turning point in Allchin's career. As it had happened earlier with Colin Mackenzie, Alexander Cunningham and many others, it was during this military interlude that Allchin had his first exposure to India's history and its wealth of archaeological sites. While his visits to Sanchi and other monuments in Central India made a lasting impression on him, his exposure to the Indian way of life allowed him to develop a deep sense of appreciation of its religious and spiritual dimensions. These impressions about

India and its history and heritage were so strong that on his return to England Allchin, instead of pursuing his architectural studies, chose to convert his newly found but deep interest in the Indian heritage into a life-long mission. He enrolled for a post-graduate degree in the Indian studies at the School

Received : 23-9-2010
Revised : 05-11-2010
Accepted : 18-01-2011

of Oriental and African Studies (SOAS) in London and completed it in 1950. This degree also included courses in Sanskrit and Hindi, which he later put to admirable use in his archaeological research.

With a view to pursuing his Indian studies further Allchin stayed on at the SOAS and commenced work on a doctoral thesis. For this he selected the Raichur Doab lying between the rivers Krishna and Tungabhadra. His selection of the Doab was influenced by the availability of rich historical as well as archaeological evidence. To historians the Doab is familiar since long as the bone of contention between the Vijayanagara empire and the Deccan Sultanates. The battle of Talikot which sealed the fate of the Vijayanagara empire actually took place near the villages of Rakshasgi and Tangadgi close to the Krishna river.

Coming to archaeological sites, the Doab is again extremely rich. Some stone flakes were found at Lingsugur by one Dr. Primrose in the middle of the 19th century. In the second half of the 19th century many more discoveries were made. Robert Bruce Foote (1916: 122-129) discovered several Neolithic, Iron Age and Early Historical sites, of which Billamrayangudda, Kotegal, Anandgal, Watgal and Maski are the major ones. In the second quarter of the last century Leonard Munn of the Geological Department of Hyderabad reported additional Neolithic and Iron Age sites (Munn 1934, 1935 and 1936). The Nizam's Department of Archaeology carried out an excavation at Maski, where a minor rock edict of Asoka had been found in 1914. Allchin's choice of the Doab was also presumably guided by B. Subbarao's doctoral thesis on the archaeological sites of the adjoining Bellary district which had been completed in 1949 (Subbarao 1948, 1949).

With these clues Allchin undertook his own field surveys in the Doab in 1951 and 1952. These surveys enabled him to make a systematic study of the sites found by earlier workers. He also brought to light many more Neolithic and Iron Age sites. As part of these field studies Allchin carried out in 1952 a large-scale excavation at the site of Piklihal located only a short distance from the medieval fort of Mudgal. It is a large site-complex nestled in a cluster of granite hillocks and contains different localities such as a settlement area, an ashmound, stone circles and a stone alignment, fortifications, and rock paintings and bruisings (Allchin 1960: 1-25). Allchin's excavation exposed deposits ranging in age from the Neolithic to Medieval period. Two years later, in 1954, the site of Maski was excavated by B.K. Thapar on behalf of the Archaeological Survey of India (Thapar 1957). Allchin's thesis entitled *The Development of Early Cultures in the Raichur District of Hyderabad* was completed in 1954.

Allchin's work in the Raichur Doab, together with Subbarao's study of early sites of Bellary district and Thapar's excavation at Maski, inspired several younger research scholars in the 1960s and 1970s to take up archaeological investigations in Andhra and Karnataka comprising the districts of Dharwar, Bijapur, Gulbarga, Kurnool and Anantpur. They include M.S. Nagaraja Rao (1966), A. Sundara (1975), V. Rami Reddy (1968), K. Paddayya (1968) and R. Korisettar (1980).

Allchin incorporated the main results of excavation at Piklihal in his thesis. He published the full report under the title *Piklihal Excavation* in 1960 under the sponsorship of the Government of Andhra Pradesh (Allchin 1960). This was facilitated by Dr. N. Ramesan, Director of Archaeology. Indeed for all of Allchin's work in the Deccan, Hyderabad served as the base, as it is the closest major city to the actual scene of field studies and offered many logistical advantages. Moreover the Raichur Doab was part of the Nizam's State which kept close relations with the British colonial power (both politically and militarily). So Allchin was able to strike a good rapport with the archaeological department of the princely state when he commenced his field research in the Doab in 1951.

The report on Piklihal excavation deserves a few additional observations. Following upon the reports on Brahmagiri (Wheeler 1948), Sanganakallu (Subbarao 1948) and Maski (Thapar 1957), it is the fourth major publication devoted to the Neolithic and succeeding cultures of South India. The report covers the finds belonging to the Neolithic, Iron Age, Early Historical, Early Medieval and Late Medieval periods and as such clearly establishes continuity of human occupation in the Doab.

The Neolithic culture forms the report's principal focus. The ceramic assemblage of this period was subjected to a systematic classification for the first time (Allchin 1960: 26-62). Allchin calls it A Ware and divides it into five major fabrics (A1 to A5) taking into account colour and other surface features. This pottery is hand-made or else fashioned on a slow wheel as formed by turn-table. It includes grey, buff, red and black fabrics. Surface decoration includes incised designs and post-firing, ochre paintings. There is also a red/brown ware (A3), sometimes bearing purple/black pre-firing paintings with simple designs. Allchin also hints at the possibility of chronological ordering of the fabrics. He systematized typology of vessel shapes and recognized as many as 70 types including some rare types like bell-shaped jars and legged bowls. In this connection attention may be the drawn to his recognition of pottery head-rests as a distinct type from T. Narasipur on the Kaveri (Allchin 1966). Furthermore, Allchin for the first time looked into the functional aspects of these types and identified various general household purposes – for cooking and eating; for storing liquids and water; for storing food-grains, etc.; for milking and milk boiling; and for ritual purposes.

In the Piklihal report Allchin put forward a two-phase division of the Neolithic chronology (Allchin-1960: xv-xvi). In a later publication the Allchins recognized three phases (Allchin and Allchin 1968: 161-166). Phase 1 (c. 2300-1800 B.C.) is characterized by simple stone tool industries, hand-made pottery, and domestic animals. Ashmounds Allchin's principal substantive contribution to the date to this phase. Phase 2 (1800-1500 B.C.) shows developed stone tool industries, wattle-daub structures and copper artefacts towards the end. Phase 3 (1500-1000 B.C.) shows an increase in the number of copper artefacts and red-on-black painted pottery, both probably derived from the Northern Deccan Chalcolithic.

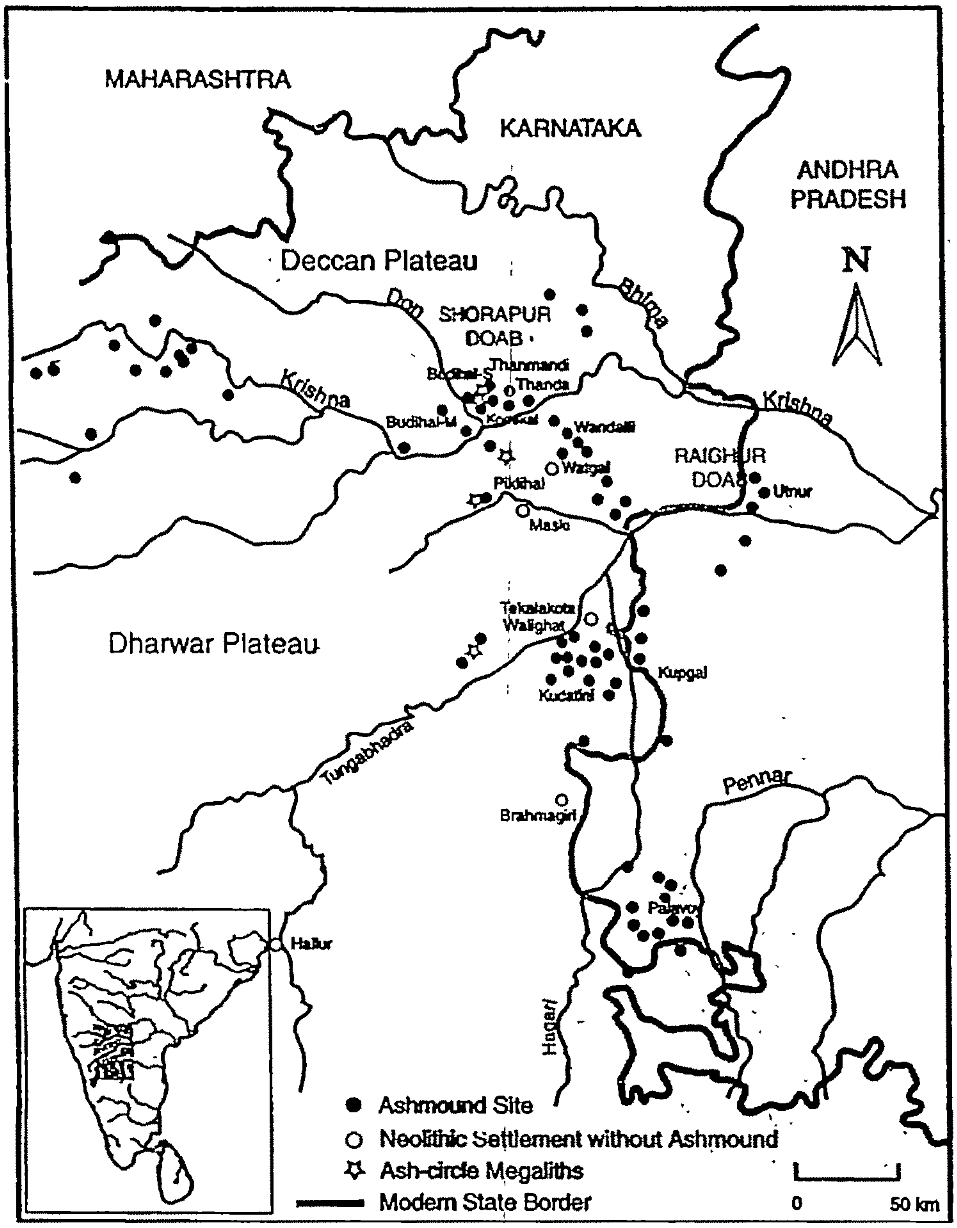
In addition to cultural remains, Piklihal excavation also yielded other finds. Allchin took care to have these finds studied by respective experts. Thus the report has a well-written note on animal remains (Allchin 1960: 114-120). Dr. A. Anantanarayana Ayer, Professory of Human Anatomy, Chennai, gave a detailed report on human skeletal remains found in the burials exposed in the excavation (Allchin 1960: 143-154).

In short, the Piklihal report occupies a special place in the literature on the South Indian Neolithic. The reports on the sites of Brahmagiri, Sanganakallu and Maski were no doubt systematic and detailed but were essentially descriptive accounts of the various kinds of cultural remains found in excavation. The Piklihal report went one step ahead and made an admirable attempt to interpret the archaeological record in terms of the lifeways of Neolithic people. Part III of the report, entitled 'Interpretation, Chronology and Conclusion' and running to some 20 pages, is a detailed statement on various aspects such as culture sequence at the site based on stratigraphy and ceramic data; its comparison with the sequence from Brahmagiri, Sanganakallu and Maski; comparative analysis of the Southern Neolithic sequence with cultural record from Northern Deccan, Malwa, Saurashtra, Indus valley and the Iranian plateau; and cultural make-up of the Lower and Upper Neolithic, and other periods forming part of the culture-sequence at the site (ceramics, lithic technologies, cattle and sheep/goat pastoralism, ornaments and rock art). Finally, based upon close similarities in the ceramics of the two regions, Allchin accounts for the origins of the Deccan Neolithic in terms of a movement of people from the Iranian plateau (Allchin 1960: 122-142). He phase division of the Neolithic chronology (Allchin maintained this proposition in later publications with some modifications.

Problem of Ashmounds

Allchin's principal substantive contribution to the archaeology of the Deccan concerns his work on the ashmounds. His comprehensive theoretical statement on this topic came in 1963 in the form of a monograph entitled *Neolithic Cattle-Keepers of South India: A Study of the Deccan Ashmounds* (hereafter just *Cattle-Keepers*), which is a landmark publication in the archaeology of post-independence period (Allchin 1963). It merits detailed comments.

Southern Deccan has well over 150 ashmound sites (Fig. 1). These are spread over the districts of Gulbarga, Bellary, Raichur, Bijapur and Belgaum in Karnataka and Mahbubnagar, Kurnool and Anantpur in Andhra Pradesh. Colin Mackenzie and his Indian assistants noticed the mounds at Kudatini and a few other places in Bellary district in the beginning years of the 19th century (for a detailed historical account, see Allchin 1963: 1-5). Subsequently additional sites were found by the geologist Newbold in Bellary area. It was however Robert Bruce Foote (1916) who not only found more ashmounds but also gave serious attention to the problem of their nature and age. Foote was struck by the close proximity of these mounds to Neolithic sites and in fact found Neolithic pottery and stone tools in some of the mounds. He also got some ash samples chemically analyzed in


MAHARASHTRA
KARNATAKA
ANDHRA PRADESH
N
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Piklihal
Maski
RAICHUR DOAB
Utnur
Tekkalakota
Walighat
Dharwar Plateau
Kupgal
Kudatini
Tungabhadra
Pennar
Brahmagiri
Palavoy
Hallur
Hagari
Ashmound Site
Neolithic Settlement without Ashmound
Ash-circle Megaliths
Modern State Border
0
50 km

Fig. 1. Map showing important ashmound and other Neolithic sites in Southern Deccan (After Johansen 2004)

the laboratory of Presidency College at Chennai. Based upon these field and laboratory studies and also the Zariba practice current among the pastoral groups of East Africa, Foote concluded that these mounds were part of the Neolithic settlements and that the ash deposits resulted from accidental burning of cow-dung accumulations. In the second quarter of the 20th century Leonard Munn reported additional ashmounds from the Raichur Doab and he was inclined to ascribe industrial origin to the deposits. Thus by the mid-20th century various theories were put forward about the ashmounds: a) local legends and traditions treating the mounds as ancient cremation grounds of demons, mass sati immolations, etc.; b) accounts treating ash deposits as volcanic tuff and other forms of geological deposit; c) views linking them to ancient industrial processes such as iron smelting; and d) Foote's inference about their Neolithic age and burnt cow-dung origin.

Allchin's own curiosity was aroused by his visits to some of the sites in the Raichur Doab as part of his doctoral research but he could include only a brief note on this topic in the thesis. It was against this background that he took up this topic for

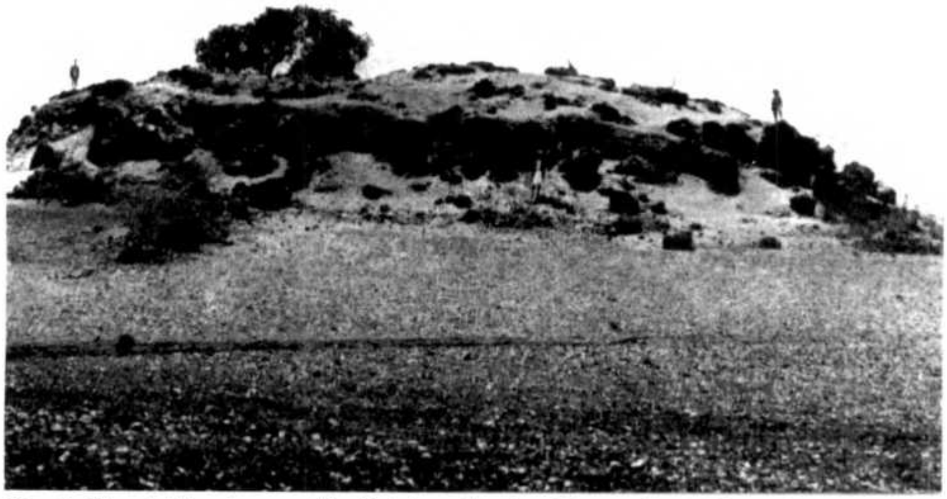

Fig. 2. Wandalli ashmound in Raichur district, Karnataka (After Allchin 1963)

further probing. Allchin mentions that he selected the ashmound problem in spite of the fact that a celebrated archaeologist (one suspects it to be Sir Mortimer Wheeler?) advised him to the contrary and dismissed the mounds as heaps of industrial waste resulting from iron working (Allchin 1963: xi).

Obviously detailed field studies involving fresh explorations of important ashmounds and large-scale excavations at one or a few sites were called for. Allchin got an opportunity to take up these field studies when he was granted study leave in 1957 by the SOAS. He spent the months of July and August in carrying out explorations at the major ashmounds in the area, followed by three weeks of excavation work at Utnur in the Mahbubnagar district. A full report on the Utnur excavation was later published by the Andhra Pradesh Government (Allchin 1961). The results of all these field investigations were incorporated in *Cattle-Keepers*.

Allchin's work on the ashmounds is an excellent example of the progress of scientific research from a general topic to a specific problem and of the application of the scientific (hypothetico-deductive) method in factual sciences – preliminary probings into the nature of the empirical world; pulling out a sensible and most probable inference from 'the teeth of stubborn and irresistible' facts to make sense out of these; and putting this hypothetical inference in a 'witness-box and cross-examine' it in the light of systematically assembled data from the empirical world. Commenting on this aspect, Allchin himself states that "In retrospect it is the methodological interest of the inquiry, no less than the result itself, which stands out" (Allchin 1963: ix). Elaborating his observation, Allchin writes: "..The problem of the ashmounds was solved first by Newbold and Foote through their observations at actual sites. The further proofs arose from laboratory tests of ash. By the end of the nineteenth century the matter should have been finished, and yet until the middle of the twentieth century no worker who considered the problem was prepared to accept Foote's hypothesis, and – what is more – no archaeologist was sufficiently interested to submit the hypothesis to experimental test. Archaeological research methods are, in their way, linked to those of science – in the collection of observational data, the framing of hypotheses, and the testing of hypotheses experimentally. The experiments take the form of further field and laboratory observations and as they arise from the hypothesis framed in the earlier stage they are oriented accordingly …" (Allchin 1963: xii). This is an amazingly apt explication of the scientific method or method of hypothesis testing and it is equally amazing that Allchin's actual employment of it in connection with the ashmound problem took place

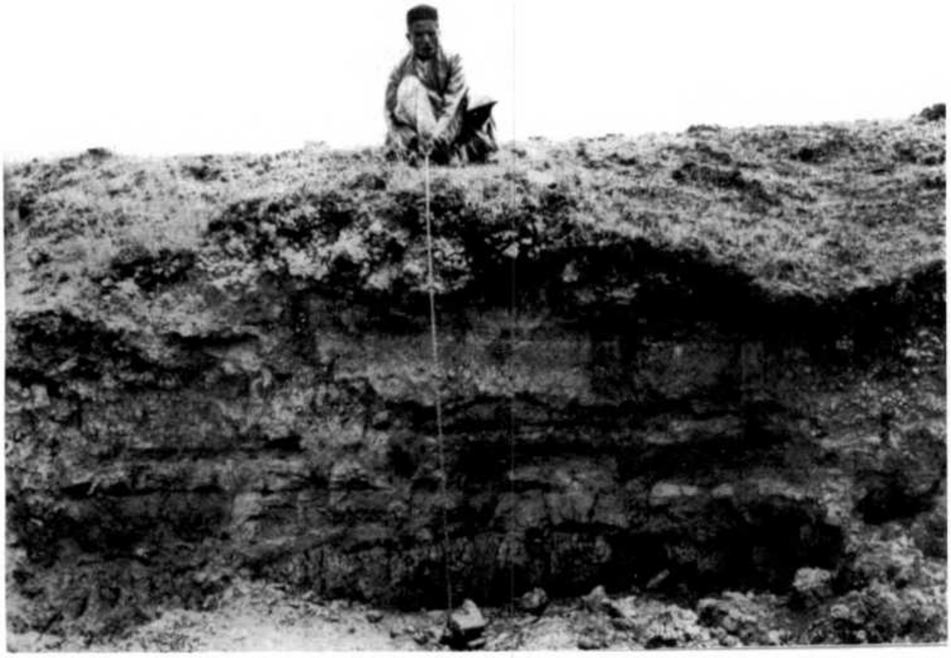

Fig. 3. Ashmound at Gaudur in Raichur district, Karnataka (After Allchin 1963)

when the much talked about New Archaeology was not yet in sight in North America!

While Allchin's overall approach to the ashmound problem is indeed a praiseworthy exemplification of the method of hypothesis testing, his collection and presentation of data from the empirical world emphasize at the same time the importance of the much despised traditional archaeology and its inductive methodology. Chapters 4 and 5 of *Cattle-Keepers* are very important from this point of view.

Chapter 4 gives details about Allchin's personal visits to over 35 ashmound sites spread over the districts of Mahbubnagar (Andhra Pradesh), Raichur and Bellary (Karnataka). Among these Gaudur and Wandalli in Raichur district and Kupgal and Kudatini in Bellary district are major sites (Figs. 2 and 3). From one of the photographs (Allchin 1963: Plate 10) it would appear that B. Subbarao accompanied Allchin during his visits to the Bellary area (Fig. 4). These visits enabled Allchin to obtain accurate information about the locational setting of ashmounds, their sizes and closeness to other archaeological sites, and also to collect pottery, stone objects, animal bones, etc. found on and around the mounds. For the first time stratigraphy of ash deposits was recorded at all major sites like Kupgal, Kudatini, Wandalli and Gaudur where sections were exposed. The mound at Kudatini, perhaps the largest one, is oval on plan and measures 150 ft. (45 m) in diameter and 25 to 30 ft (7.5 to 9 m) in height. Allchin recorded as many 12 layers of grey and brown soil and soft and vitrified ash. He also noted that the ash accumulation took place on a well-prepared *moorum* surface. Allchin estimated that the mound contains two lakh cubic feet (56,000 cubic metres) of ash deposit. Munn estimated that the Wandalli mound had a deposit of 1.75 lakh cubic feet (49,000 cubic metres).

Chapter 5 presents a detailed study of the cultural material collected by Allchin from the sites, and also of the collections made by Foote and Munn. This material comprises pottery, chert artefacts, ground stone objects and animal bones. Barring a few sherds of the Iron Age pottery, all this cultural material is clearly Neolithic in character and leaves one in no doubt about the age of ashmounds. This chapter closes with details about the laboratory tests of ash samples conducted by W.E. Smith in the 19th century and by J.D. Aitken and F.E. Zeuner in the 20th century. These tests proved beyond doubt that the ashes contain essentially (> 60%) vitrified skeleta of grasses and other vegetable matter, thereby ruling out long suspected interpretations of the mounds as industrial waste, geological deposits, etc.

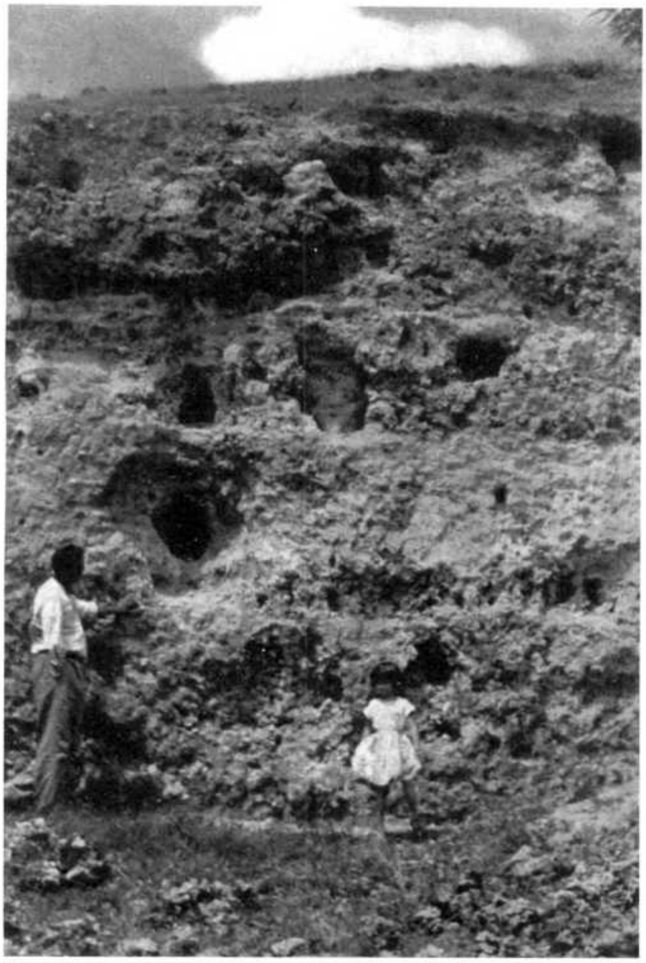

Fig. 4. Ashmound at Kudatini in Bellary district, Karnataka. Note the figure of B. Subbarao (After Allchin 1963)

Emboldened by these explorations which clarified the Neolithic age of the ashmounds and their probable character as cattle pens, as suggested by the cow-dung origin of ash deposits, Allchin conducted three-week-long (in September 1957) excavation at the Utnur ashmound located in the Mahbubnagar district of Andhra Pradesh (Allchin 1961). Chapters 2 and 3 of Cattle-Keepers present the results of this excavation. Utnur lies about 35 km southeast of Raichur town. This site is squarish on plan, with each side measuring about 200 feet (60 m) in length. Although Allchin himself did not recognize this, on the basis of my personal visit to the site in 1995 and my own excavation at the Budihal site, I feel sure that the Utnur site consists of two parts: a) the lower part in the east (with 80 cm to 1.5 m thick ash deposit) representing the cattle penning area and b) cow-dung dumping and burning area (badly disturbed in more recent times) on the western side, reaching a present height of about 3 m. During my visit I noticed 30 to 40 cm thick Neolithic habitation deposit in the agricultural land immediately adjacent to the lower ashmound but this too seems to have escaped Allchin's attention. Allchin's excavation in the upper ashmound exposed a nearly one-metre-thick vitrified ash deposit in the upper part, thereby authenticating its identification as cow-dung disposal and burning area.

It is the four main trenches excavated in the lower ashmound area which provided the much needed evidence for cattle penning activity in the form of a low earthen embankment, lines of post-holes forming part of a wooden fencing structure and cattle-hoof impressions (Figs. 5-7). The site occupation took on a levelled *moorum* surface. The excavation exposed 75 cm to 1.5 m thick stratigraphy consisting of 12 layers. Five of these layers are made up of fine ash and the rest of light brown soil. Although Allchin did not recognize this feature, the light brown soil layers consist of nothing but decomposed (i.e. unburnt) cow-dung. Interpreting this archaeological evidence in terms of site history (Chapter 9), Allchin recognizes four major periods of cattle occupation, each ending in cow-dung burning and ash accumulation. The site witnessed five major and many smaller cow-dung burnings. The structural evidence of pen preparation consists of laying an earthen embankment and a wooden fence around it, as indicated by post-holes which once held wooden posts. Excavation also exposed evidence of human occupation around the penning area. Allchin computes that the Utnur pen varied in size between 200 ft (60 m) and 180 ft (54 m) on each side and held between 540 and 650 animals. The site was occupied for a period of 40 to 100 years. Charcoal sample from period I gave a ^{14}C date (uncalibrated) of 2160 ± 150 B.C.

Chapter 3 gives an account of the objects found in the excavation (Figs. 8 and 9). Barring some later pottery (Early Historic and Medieval) found in the upper disturbed levels, Utnur excavation yielded pottery and blade and polished stone artefacts which are clearly Neolithic in age. In addition, one infant burial was found in the levels of Period I and animal bones were found commonly in all levels. All these objects, together with the ^{14}C date, establish beyond doubt the Neolithic age of the site and its character as a cattle pen.

Not content with the positive results obtained from explorations at a large number of sites and

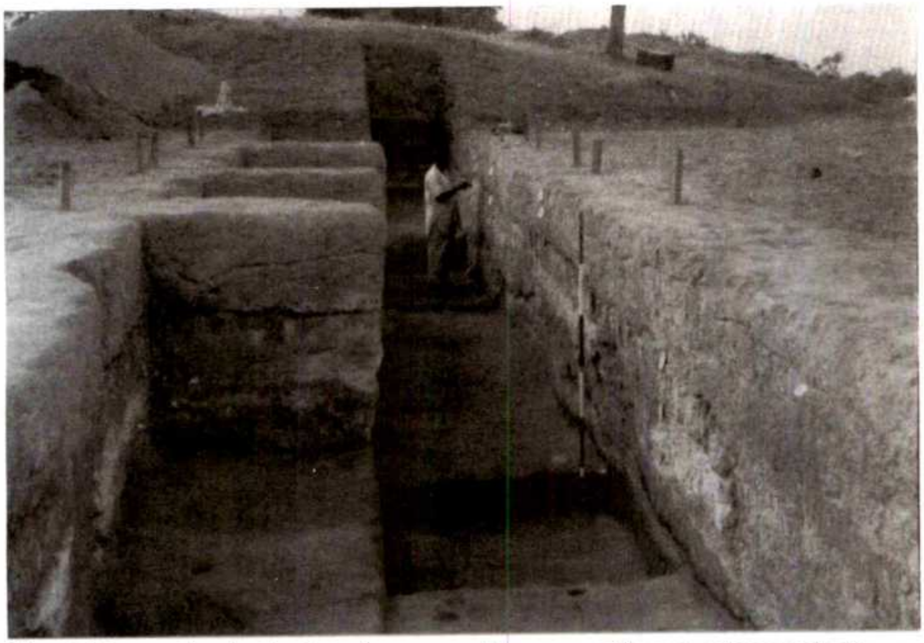

Fig. 5. Excavation in the interface area of upper and lower ashmounds at Utnur (After Allchin 1961)

excavation at the Utnur ashmound, Allchin sought to strengthen his body of archaeological evidence with ethnographic information. He made serious efforts to obtain this information and presented it in three valuable chapters (Chapters 6 to 8). It is important to realize here that Allchin employed this methodological approach, and very effectively, at a time when ethnoarchaeology was yet to find formal recognition in Indian archaeology. In Chapter 6 he presents data to show that a good number of places in South India have names with *budi* (Dravidian word for ash) as prefix (Budidibba, Budigunta, Budihal, etc.). Broadly speaking, the area covered by these places correlates with the spatial distribution of ashmounds. I would like to add that I found these place-names with *budi* prefix very helpful in identifying new ashmound sites in the Shorapur Doab. I wholeheartly support Allchin's proposition that "It may even be … that the *budi* place-names are direct survivals of cognate names by which the ashmounds were known by their makers" (Allchin 1961: 94). Some of the oral traditions among the rural people recorded by Allchin state that the ashmounds are cattle-pens of ancient times.

Considering that pastoralism, particularly of cattle and sheep/goat, is still a dominant aspect of rural India and that these animals are given special attention on certain festival occasions like Pongal and Holi, it is only to be expected that Allchin devotes some space (Chapter 7) for discussing the animal-keeping practices current among pastoral groups of peninsular India such as the Todas of the Nilgiris, the Gollas with more than one clan group, the Banjaras and the pastoral groups of Mirzapur – their cattle-breeding practices and material culture.

Chapter 8 is a fine, 30-page-long anthropological account of pastoral elements as they find expression in folk religious traditions of peninsular India, with special reference to practices involving cattle and fire. Allchin intends to find in these practices clues for the repeated cow-dung burnings. In order to emphasize the relevance of these apparently simple practices of cow-dung burnings, Allchin quotes E.B. Tylor's statement from his book *Primitive Culture* that such beliefs are not a "rubbish-heap of miscellaneous folly" but are "consistent and logical in so high a degree as to begin, as soon as even roughly classified, to display the principles of their formation and development"(Allchin 1961: 114). After a reference to the religious practices of the buffalo-rearing Todas, e.g. the *teutütusthchi* ceremony involving the lighting of ceremonial fire in the hills by dairy priests to promote grass and honey growth, Allchin turns his attention to folk religious practices involving cattle and fire in Andhra, Karnataka and Tamil Nadu.

The high esteem in which the cattle are held among the rural communities of these areas is revealed by the elaborate ways these animals are

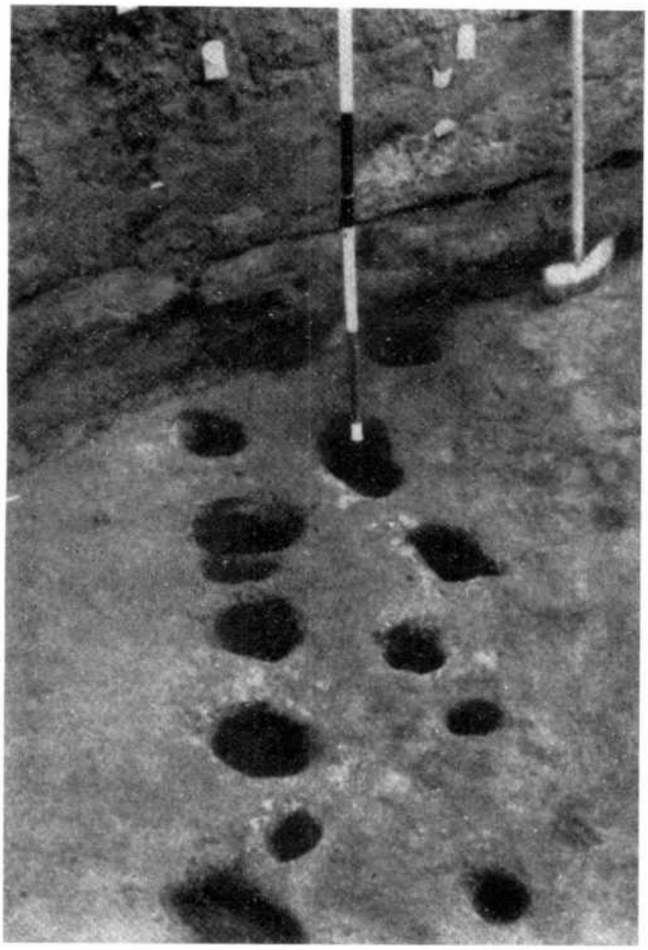

Fig. 6. Alignment of postholes exposed in lower ashmound (cattle-penning) area (After Allchin 1961)

decorated on festival days like Holi, Pongal and Gokulashtami. The body is decorated with stripes and other patterns painted in red pigment. Even the necks are decorated with collars of leather bearing small bells stiched in rows along the two edges. Likewise, ribbons or strings of beads are tied to the horns. Body decoration apart, there are ceremonies like lighting of lamps in the cowsheds and feeding of animals with sweets. Then there are sports involving cattle, such as bullock racing and baiting, and processions. *Jalli Kattu* or bull-baiting ceremony current among the Maravans of Madurai district in Tamilnadu has recently been banned by the Supreme Court. Similar practices are prevalent in Khandesh, Andhra and Karnataka. In these areas and in South Maratha country bull-racing is also a common practice. All these practices are not only widely prevalent geographically but find mention in ancient texts like Tamil Sangam literature. Allchin then also makes a reference to the important role which cattle-fairs play in southern Deccan; these are held periodically on important festival occasions. He then gives details of cattle-related rites in vogue in various parts of peninsular India on the occasion of important festivals like Holi and Diwali in the northern zone and Pongal in South India. This chapter closes with a brief note on cattle and fire-related festivals prevalent in Europe and Iran.

As the old saying goes, the proof of the pudding is in the eating. What is the import of archaeological and ethnographic evidence so assiduously assembled by Allchin? It is this query which engages Allchin's attention in Chapter 10 of *Cattle-Keepers*. He is at his interpretative best; and this chapter is a fine exercise in what has now come to be called post-processual archaeology, which lays emphasis on retrieval of meanings in terms of human motives and intentions from the archaeological record. Pooling together now the hard archaeological data, the evidence of place-names, oral narratives and textual accounts, and the ethnographic data pertaining to pastoral practices and pastoral elements concerning cattle and fire in folk religion, Allchin puts forward his interpretation of the culture historical significance of this unique class of archaeological sites.

Briefly stated, Allchin is convinced that the ashmounds were Neolithic pens where the cattle were herded together at night and that some of these pens were close to the Neolithic settlements proper and others located away in forest settings. In a later publication he expressed the view that these pens were also used for domesticating wild cattle (Allchin and Allchin 1974). The pens were in use for a considerable period of time (up to a few hundred years) and underwent their own structural history. As per Utnur evidence, this consisted of an initial earthen embankment around the pen, followed by a strong wooden fence and, finally, the creation of an ash wall around the pen. The accumulated cow-dung was burnt periodically and this coincided with seasonal migrations in the case of forest pens. The ash burnings were intentional and eventually developed into an ash-fire cult meant for promoting the fertility of cattle. The cattle were led through a moderate fire of cow-dung on these occasions. All those who are familiar with the peasant way of life in South India and the central place which cattle occupy in it will wholeheartedly endorse Allchin's ingenious reconstruction of the meanings of ashmounds. It is remarkable that such fire-related cattle rites are still in

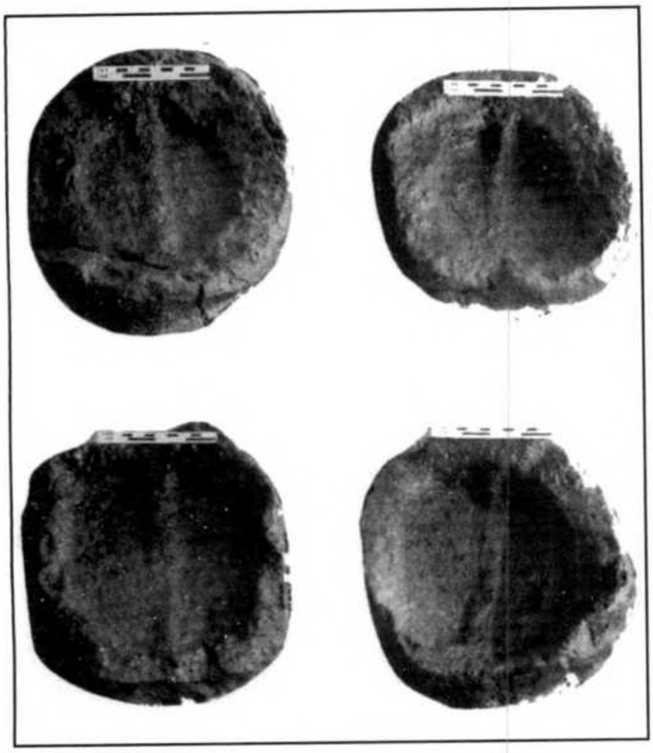

Fig. 7. Cattle hoof-impressions exposed in lower ashmound excavation (After Allchin 1961)

vogue in South India. For example, in Siddalingapura village near Mysore cattle are led through cow-dung fire on the occasion of Pongal (*The Hindu*, Hyderabad edition, dated 17 January 2009).

We may sum up this part of our paper by saying that Allchin's work on the ashmound problem has four-fold importance in archaeology. First, it is an excellent illustration of the significance of problem-oriented approach in Indian archaeology – initial data leading to the formulation of a coherent or probable hypothesis and testing it with reference to fresh archaeological data as well as the evidence of oral accounts, textual references and ethnographic information. Secondly, it is also a measure of Allchin's deep understanding and appreciation of the time depth of the Indian culture that he views ashmounds as providing a link in the historical continuity of cultural forms in this part of the world. Thirdly, Allchin strongly believes that ashmounds and the meanings these embody in terms of human motives enrich our understanding of the history of human institutions at the global level. In his own words: "… However it may ultimately be found to relate to the cult of cattle throughout India, and however humble the theme may appear beside the grander flights of Indian religious thought, *at least we may assert that what we have been able to reconstruct is something unique and hitherto undreamed of; and as such it adds a new and peculiarly Indian chapter to the history of human institutions"* (emphasis added) (Allchin 1963:178). Fourthly, *Cattle-Keepers* affords a fine example of the use of inductive methodology and at the same time also made use of the procedures of hypothesis testing, regional orientation to archaeological record and reading human motives from it which in subsequent decades became principal components of processual and post-processual archaeologies. Thus Allchin deserves a place in the development of theory and method in the discipline.

The uniqueness of the phenomenon of ashmounds resides in the fact that out of the mundane activities of garbage clearance from the cattle penning area, its dumping at one specific spot and subsequent burning, which simultaneously ensured clean penning areas, mitigation of foot and mouth diseases of cattle and warding off wild animals from the settlement area, there grew up an elaborate set of rites and ceremonies involving both animal herds and site inhabitants. In a larger sense, ashmounds form a good example of Secondary Products Revolution – a concept coined by Andrew Sherratt (1981) to capture the importance in the Neolithic societies of items other than meat (milk, dung, bones, etc.) derived from domestic animals.

Allchin's Work on Ashmounds in the Light of Later Investigations

It is now close to half a century since *Cattle-Keepers* appeared in print. What is the current status of Allchin's interpretation? I strongly believe that it remains unchallenged. It is true that Rami Reddy's work on the ashmouns of Anantpur district has revived the old theory linking ash deposits to iron smelting (Rami Reddy 1976). The evidence consists of an iron nail and a ring, small iron slag pieces, and dome-shaped 'ovens' which Rami Reddy found in the vitrified ash layers exposed in the Palavoy excavation. This interpretation rests on flimsy grounds because during my personal visit to the site I noted that the ovens are nothing more than natural cavities or fissures formed in the ash layers due to differential firing of cow-dung deposits. It is also most probable that the small iron objects and slag pieces are later intrusions into the ash layers. Considering that the granitic area is very rich in iron ore deposits, it is possible that some ore pieces got accidentally

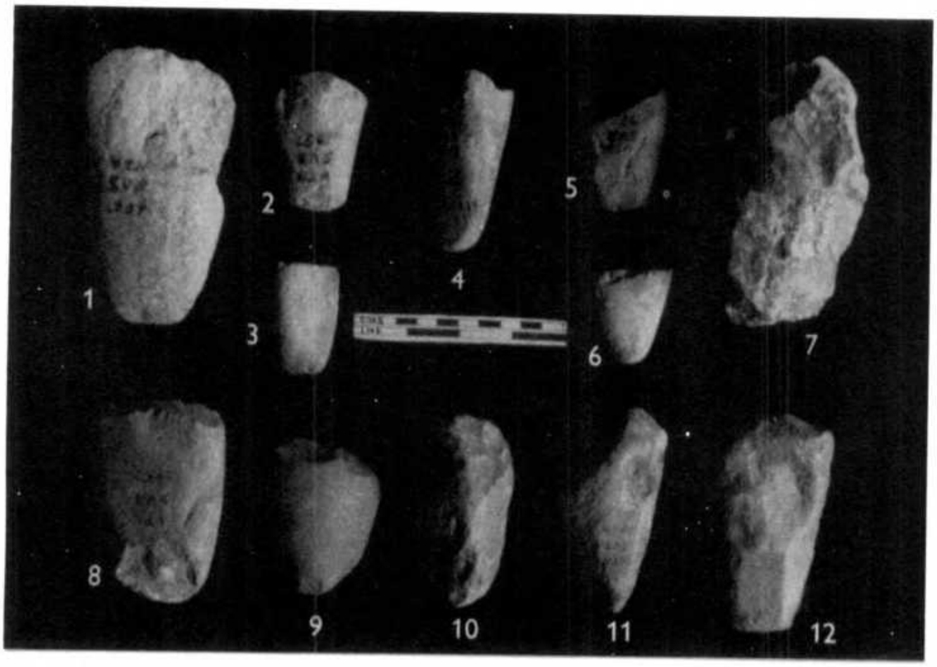

Fig. 8. Polished stone axes found on surface at Utnur (After Allchin 1961)

incorporated into the cow-dung deposits and were subjected to burning. The proposed evidence of iron smelting from Palavoy stands no comparison with brick ovens and slags found at true iron-working sites like Naikund in Vidarbha and Banahalli near Bangalore.

Sundara (1971, 1987) found several ashmound sites in the Upper Krishna basin and ascribes them to the late Chalcolithic or early Iron Age. This view is based on his recovery of a black-and-red ware vase from the top levels of the ashmound at Venkatapur near Hospet in Bellary district. The occurrence of objects of later periods in the deposits of earlier periods is not uncommon in India due to continuous occupation of certain places in various periods. Such cases need to be carefully studied from the point of view of formation processes.

Actually there are several other studies which broadly support Allchin's views. Mujumdar and Rajaguru's excavation in the ashmound at Kupgal near Bellary confirmed the Neolithic age of the site (Mujumdar and Rajaguru 1966). It produced Neolithic pottery and stone artefacts from vitrified ash and soil deposits exposed in the excavation. Their laboratory studies confirmed the cow-dung origin of ash deposits. This was reconfirmed by the laboratory tests of ash samples from Kudatini, Kupgal and Sanganakallu conducted by Joshi and Deotare (1983: 77-79). The site of Hulikallu in Anantpur district of Andhra Pradesh was excavated in 1979 and it also produced evidence of cattle penning, ash formation and human settlement (Krishna Sastry 1979).

As part of their Sanganakallu-Kupgal Project in Bellary district, Boivin and her co-workers recognized an ash deposit in the centre of the Neolithic settlement located on top of the Sannarasamma hill. This site is dated between 1990 and 1750 B.C. (Boivin, *et al.*, 2005). Boivin endorses Allchin's ritualistic interpretations and finds cosmological meanings in the very locations of Kudatini and Toranagallu ashmounds. In her own words: "… the spatial patterning of ashmounds at the two sites would seem to take advantage as much of significant views, patterns of intervisibility, local solar events and cardinal directions as ecological and environmental factors (Bovin 2004: 246). Likewise, Johansen has followed up my own suggestion about the aspect of moumentality represented by ashmounds (Paddayya 1993: 597) and completed a dissertation on this topic (Johansen 2004).

My own work on the ashmounds of the Shorapur Doab since 1965 makes me quite comfortable with Allchin's interpretative framework. As part of my doctoral thesis I carried out in 1967 a small excavation at Kodekal which exposed ashy layers separated by brown soil layers, all yielding typical Neolithic cultural material consisting of ceramics, stone tools and animal bones. The ^{14}C date of 2335

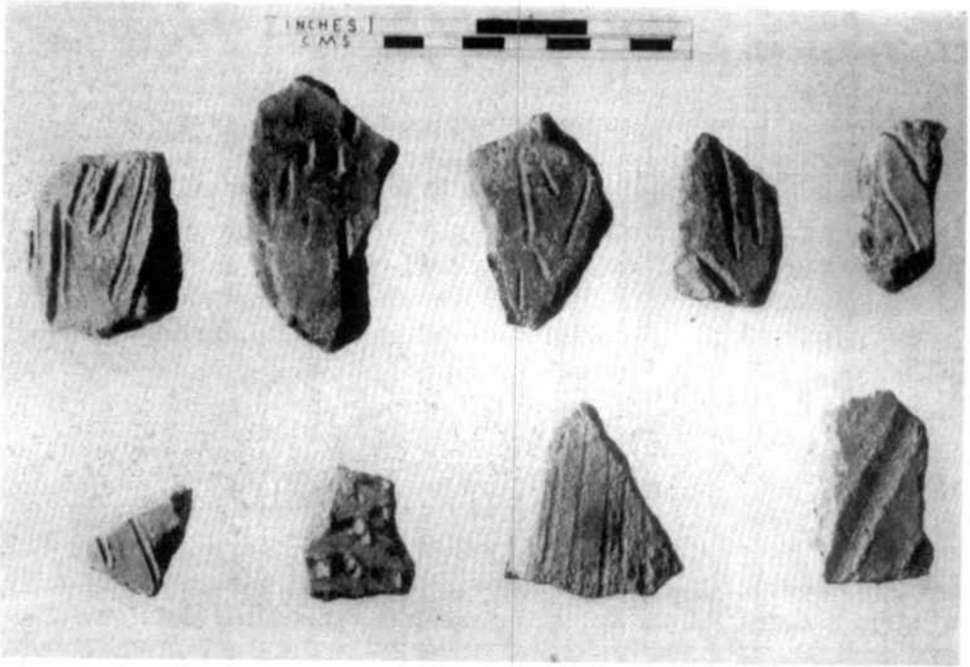

Fig. 9. Incised Neolithic pottery found in excavation at Utnur (After Allchin 1961)

B.C. (uncalibrated) further confirmed the Neolithic age of the site. Later in that year I had an occasion to take both Raymond and Bridget Allchin to Kodekal and other Neolithic sites of the Doab. They were obviously pleased with the results of my field studies but advised me to go beyond pigeon-holing while dealing with this topic.

Their suggestion became a reality two decades later. Encouraged by the identification of true Neolithic occupation deposit around the ashmound at Budihal near Kodekal in 1988, I carried out fresh, landscape-oriented explorations at other sites in the Doab. This was followed by visits to major sites in the Raichur, Bellary, Kurnool and Anantpur districts. Everywhere Neolithic habitation deposit was encountered around the mounds. This evidence, in addition to location of ashmounds in close relationship with landscape features like water sources, pasture and other resources, led me to hypothesize that the ashmounds were not mere cattle-pens but probably represent full-fledged Neolithic pastoral settlements (Paddayya 1993).

In order to test this proposition a large-scale excavation was conducted at the Budihal site for six seasons from 1990-91 to 1996-97 (Paddayya 1998, 2002; see also Paddayya, Thomas and Joglekar 1995; Khrisat 2007). This is a large site measuring 400 m x 300 m in extent and consists of four localities. It has additional features like grinding grooves and an extensive chert workshop. Our excavation at Locality 1 (about 2 ha in extent) exposed various functionally distinct areas, viz. cattle-penning area, cow-dung disposal and burning area, human habitation area, and an animal butchering platform. Budihal is a single-culture site (Neolithic) and the available ^{14}C dates (uncalibrated) range between 1900 B.C. and 1400 B.C. The ashmound area, apart from ash layers, also exposed unburnt or decomposed cow-dung deposits, thereby leaving us in no doubt about the cow-dung origin of the mounds.

Further, from my own childhood experience in a peasant setting in the coastal Andhra part of South India I am aware of the high esteem in which cattle are held such that the dead bodies of domestic of cows/bullocks are ceremonially buried on farmland rather than being given away to village butchers for preparing footwear and other articles. So I have no hesitation whatsoever in endorsing Allchin's observations about the Neolithic age of ashmounds and the existence of a Neolithic ash-fire cult.

Having made these observations, let me admit that the final word on this topic of ashmounds has not yet been said. First, while it is true that the major concentration of ashmounds is in southern Deccan, there is a distinct possibility that ash deposits of cow-dung origin occur in other areas too.

Budititu reported from Mysore district of southern Karnataka is an indication that ashmounds do occur in other parts covered by the Southern Neolithic culture. Sundara (1987: 320) noticed layers of scoriaceous ash in the trench-sections of Brahmagiri excavation undertaken by Wheeler. The present writer identified similar layers of ash in the sections of trenches excavated at Watgal in Raichur district by Jim Schaffer in 1991 and 1992 (Devaraj *et al.* 1995). In the Shorapur Doab many mounds have been flattened due to intensification of agricultural activities but close scrutiny of land surface has made it possible to recognize the original spots. One has to bear this in mind while carrying out work in other areas. In fact, this is a fit topic for the study of post-depositional formation processes. Going outside southern Deccan, S.A. Sali reported ash deposits at the site of Kandhra in Dhulia district of Maharashtra (Sali 1987). Further, ash deposits also occur at the well-known Chalcolithic sites of Inamgaon in Maharashtra (Dhavalikar, Sankalia and Ansari 1988: 131) and Balathal in Rajasthan (Misra *et al.* 1995: 74).

Secondly, the deposits making up the ashmounds deserve more detailed physical and chemical examination. The variability in temperatures leading to soft, hard or vitrified ash types needs to be understood. Also it needs to be ascertained whether hard combustible materials like wood were added to cow-dung to attain high temperatures. Further, we also need to ascertain whether some of the thinner ash levels with fine, bluish deposits could have resulted from animal excreta other than cow-dung. It is well known that the South Indian Neolithic groups also kept sheep/goat. It is not unlikely that these animals were penned separately and the excreta dumped as a separate layer.

Thirdly, from the stratigraphic record at sites like Budihal, Kodekal and Utnur it is clear that the cow-dung accumulations were not always burnt sometimes but left to decompose, resulting in fine brownish soil-like deposit. These deposits need to be studied from the point of view of presence of insect and other small animal remains as well as plant material. Such studies may throw light on past environments including composition of pasture available for animal grazing. In this connection one may note that phytolith studies have already given good results (Eksambekar 2002).

It would be worthwhile to excavate some more ashmound sites on a large scale in order to arrive at a better correlation of settlement, cattle-penning and cow-dung disposal activities, and the use of ashmound area for various practical and ceremonial purposes including disposal of the dead. These excavations will also facilitate more detailed geo- and bioarchaeological investigations. It would also be helpful to collect additional ethnographic data from the area, particularly in respect of animal-keeping practices including diseases and traditional remedies, correlation between penning area size and size of the animal herd, and rate of cow-dung accumulation.

Other Topics of Research in the Deccan

Preoccupied though he was during the 1950s, first with his doctoral thesis and then with the ashmound problem, Allchin also published during this period several important articles on topics concerning the Neolithic culture, Iron Age and the Early Historical period of South India. In a paper entitled "Rock paintings and bruisings in Raichur, Hyderabad", jointly with D.H. Gordon, Allchin brings before readers the record of rock paintings and bruisings discovered by Munn in 1933 in the Benakal forest which was originally part of the Anegondi Samsthan of post-Vijayanagara period (Allchin 1955). These figures portray armed horsemen and other scenes, all probably dating to the early historical period. He also reported similar paintings from a few new sites discovered by himself and his wife in 1952. In a much later paper Allchin and his wife reported rock paintings and bruisings from several other sites in the Raichur Doab, of which Maski and Piklihal are very important. The horned bull figures may date to the Neolithic period (Allchin and Allchin 1996).

In another interesting paper Allchin (1956) reports the existence of a distinctive class of over 40 megalithic sites called stone alignments spread over the districts of Gulbarga, Raichur and Mahbubnagar. Meadows Taylor was the first person to report the existence of these monuments. These consist of rows (horizontally or vertically or diagonally) of rough stone blocks neatly arranged in lines and placed at equi-distance from one another. They are assigned to the Iron Age. Their purpose may be varied – some marking the spots of periodic markets or fairs and others commemorative in nature. The site of Hanasmsagar near Kodekal in the Shorapur Doab houses well over 1000 stone blocks. Vibhutihalli is another major site in the Doab.

Bruce Foote (1916: 17-24) made the first attempt at classification of ground and polished stone tools, which form one of the major and unfailing material culture components of the South Indian Neolithic. Subbarao (1948) improved upon this classification. Allchin deserves credit for making the study of these artefacts more comprehensive and more objective. His article "The Neolithic stone industry of the North Karnataka region" is an account of four collections from the Bellary area made by previous workers - those of Knox, Jardine and Gompertz housed in the British Museum, London and the collection by F.J. Richards housed in the Pitt Rivers Museum in Oxford (Allchin 1957a). After listing the various igneous and metamorphic rocks employed for making implements of various types, Allchin identifies flaking, pecking and grinding as the basic manufacturing techniques employed by the Neolithic stone-knappers. Allchin's study further revealed that five consecutive processes were adopted, particularly for making edge-tools. These are: rough flaking; fine flaking; pecking; edge-grinding; and overall grinding. Equally instructive is Allchin's classification of these artefacts into five major typological categories: a) edge-tools (axes, adzes, etc.); b) points (picks and borers); c) rubbers and grinders; d) hammer stones; and e) miscellaneous. On account of its comprehensive nature Allchin's classification is widely used by workers studying the South Indian Neolithic culture. Some years later Allchin (1962a) also published an informative article on the Neolithic stone tool collections from Santal Parganas made by Rev. P.O. Bodding in the early decades of the 20th century and deposited in the University Ethnographic Museum in Oslo, Norway. This collection has many shouldered celts which are a characteristic type of the Neolithic complex of eastern India.

Allchin also made what may well be the first explicit attempt in ceramic ethnoarchaeology in the Indian context. In the paper "Poor men's *thalis*: A Deccan potter's technique" he describes the simple technique which the potter-women of Mudgal in the Raichur Doab employ for making shallow platters or *thalis* (Allchin 1959). Here the initial shape is made on hand and then put on a saucer, which is kept on an inverted bowl and rotated as a slow wheel. This is the turn-table technique which is also used for making other shapes like *lotas*. This ethnographic study has proved to be of great help to Allchin himself in the analysis of Piklihal and Utnur pottery and is also widely cited by other workers engaged in ceramic studies.

Another pioneering study made by Allchin concerns the antiquity of gold mining. In a well-documented paper entitled "Upon the antiquity and methods of gold mining in ancient India" he refers to a number of places located in those parts of South India which are traversed by Dharwar schists containing auriferous quartz veins (Allchin 1962b). After a detailed study of the shafts at the Wandalli and Hutti mines in the Raichur Doab and of mullackers (or stone crushers) and other objects found at these sites, Allchin concludes that the Doab's gold resources were already recognized in the Mauryan period and mining in the form of digging shallow shafts commenced in the early centuries of the Christian era. He further says that placer gold or alluvial panning was already being exploited by the Neolithic people of Lower Deccan. In this connection one may draw attention to the recovery of two gold pendants from the Neolithic levels at Tekkalakota in Bellary district (Sankalia 1964: 139, Fig. 3).

Allchin also published an article in which he takes the antiquity of cotton textiles in South India to the Iron Age (Allchin 1997). The evidence for this is formed by thread-impressions occurring on the inner surface of black-and-red ware sherds which he had collected from surface at the sites of T. Narasipur and Piklihal.

Field Studies in Other Parts of South Asia

Excavation at Malwan, located in the estuary of the Tapi in Surat district of Gujarat, was Allchin's last direct involvement in Indian archaeology. This was undertaken in 1970, jointly with J.P. Joshi of the Archaeological Survey of India, for ascertaining the southern limit of the Indus civilization. Although this excavation failed to give any evidence of the Indus civilization, it revealed a two-period culture sequence (Late Chalcolithic and Historical period) (Allchin and Joshi 1995).

After this work in India Allchin widened his interest to cover other areas in South Asia. In 1963, jointly with Peshawar University, he excavated the sites of Shaikhan Dheri and Charsada in Pakistan. He also investigated protohistoric sites of the Bannu Basin in 1977-1978 and his excavation at Lewan yielded evidence of craft specialization in the production of beads and stone artefacts (Allchin *et al.* 1986). Then from 1980 to 1990 the Allchins organized and directed a British Archaeological Mission. As part of this project Robin Dennell and his co-workers discovered many Stone Age sites in the Siwalik zone of northern Pakistan and brought out several publications on their findings (Rendell *et al.* 1989). Riwat near Peshawar has been dated to 1.9 million years and the Acheulian sites of Dina and Jalalpur are dated to 0.7 million years.

Allchin also organized a British Archaeological Mission to Sri Lanka between 1989 and 1994, as part of which Robin Coningham carried out jointly with Sri Lankan archaeologists excavations at the early historical site of Anuradhapura. Coningham brought out two detailed reports on these excavations (Coningham 1996: 2006). Allchin considered the now strife-torn Afghanistan as part of South Asia from a cultural point of view and took interest in promoting the archaeology of the region jointly with other workers. He published two volumes on the archaeology of this region (Allchin and Hammond 1978; Allchin and Baker). As suggested by the title itself, *The Archaeology of Afghanistan: From the Earliest Times to the Timurid Period*, edited by Allchin and Hammond, contains chapters by senior scholars on all periods ranging from the prehistoric stage to the Mughal period.

General Syntheses

The Allchins surely did not rest content with undertaking field investigations on specific topics of South Asian archaeology and writing reports on them; they also made sincere efforts to prepare general syntheses. Continuing the British tradition of writing general texts, as represented by Stuart Piggott's *Prehistoric India* (1950), D.H. Gordon's *Prehistoric Background of Indian Culture* (1956) and Mortimer Wheeler's *Early India and Pakistan* (1959), Allchin jointly with his wife, Bridget who specialized in South Asian prehistory, published three books which present very lucid and up-to-date accounts of the pre- and protohistoric past of South Asia and are therefore widely used not only by scholars and students but also by a wide spectrum of non-specialist readers. These three books, one following upon the other after a gap of 15 years, not only reflect an enviable grasp of the ever increasing volume of data accruing from field studies and application of natural sciences, including dating methods, but also stand testimony to the skills of the Allchins in threading together various strands of evidence and weaving general patterns of the genesis and evolution of South Asian culture up to Iron Age. As such these works rank among the best known publications available to us about South Asia's early past such as B. Subbarao's *Personality of India* (1956), D.D. Kosambi's *Culture and Civilization of India in Historical Outline* (1965), Walter A. Fairservis (Jr.)'s *The Roots of Ancient India: The Archaeology of Early Indian Civilization* (1971), H.D. Sankalia's *Prehistory of India* (1977), B.K. Thapar's *Recent Archaeological Discoveries in India* (1985), and Kenneth Kennedy's *God-Apes and Fossil Men: Palaeoanthropology in South Asia* (2001).

The Birth of Indian Civilization (1968), the first of the trilogy, was occasioned by the new factual data and, in some cases, from regions hitherto unknown, that had accumulated since the publication of *Piggott's Prehistoric India* in 1950 which the Allchins consider as "a notable milestone in its field" (1968: 23). It seeks to lay bare the prehistoric (all cultural developments up to 5th century B.C.) foundations of the Indian culture. The Allchins achieved admirable success in presenting an overall picture of the culture at subcontinental level but still made a provision for recognizing individual regions and their cultures. The first half of the book provides a region-wise account of the main stages of cultural development from the Early Stone Age to the Iron Age. The second half is devoted to a treatment of general topics like settlement patterns, economy and agriculture, crafts and technology, art and religion. The book concludes with complimentary remarks about two outstanding aspects of the subcontinent; a) cultural unity amidst tremendous regional diversity and b) the continuity of cultural traditions across millennia - be they settlement patterns or house types or industrial and agricultural practices.

The Rise of Civilization in India and Pakistan, published in 1983, was aimed at presenting "a more integrated and dynamic account of the rise of civilization in the subcontinent", as facilitated by the availability of fresh research material from field studies, the availability of a new crop of publications reporting these results and also the fruits of the application of new research orientations.

These orientations called for the need to rise above typological and classificatory approaches to archaeological record and instead emphasized the importance of viewing it in terms of past cultures as functioning wholes. This necessitated an ecological approach to the record, in turn entailing a serious consideration of organic remains of various kinds, a geomorphological approach to locations of sites, and inclusion of all categories of sites for interpretative purposes. Part I deals with the record of hunting-gathering as well as the first agro-pastoral cultures of Baluchistan, Kashmir valley, northern Vindhyas, eastern and southern India. Part II is devoted to the rise and maturation of the Indus civilization. Part III gives an account of the post-Indus cultures of the Indus and Gangetic zones and peninsular India up to Iron Age. This book once again closes with insightful observations about the close relationship between geographical factors and cultural developments and subcontinental unity irrespective of regional diversity.

India's completion of half a century of its independence from colonial rule went completely unnoticed by historians and archaeologists in India. Not so by the Allchins. They saw in this event an appropriate occasion for one more stock-taking and published *Origins of a Civilization* (Allchin and Allchin 1997). This book seeks to "tell as coherent a story as is possible at the present time, of the development of human life and culture within the subcontinent, indicating the main trends, principal motivating factors and important turning points..." (Allchin and Allchin 1997: 2). The book once again takes notice of the recent findings and use of more refined research perspectives including formation processes. It opens with a chapter on the European rediscovery of the past and closes with an account of Second Urbanization. Even a casual glance through the chapters will show that the Allchins have indeed succeeded to a remarkable degree to thread together a coherent and very readable story of the development of Indian culture, composed in simple but effective English. They also draw attention to the importance of the topic of conservation of cultural heritage.

In the introduction to these general syntheses the Allchins espouse their views about the aims of archaeology and its relevance in the contemporary world. For instance, they warn us that individual finds or objects from the past are not important in themselves and cannot tell us any thing meaningful about the past. Rather it is their mutual relationships or, in other words, their contexts which are actually important for extracting culture historical information. Although not influenced in any formal way by the New Archaeology movement of the 1960s, the Allchins emphasize that ancient cultures need to be studied as totalities or functioning wholes, in relation to landscapes, climate, plants and animals. Echoing the self-knowledge concept of R.G. Collingwood, they believe that the past helps reveal the cultural identity of a group or region. It enables one "to understand one's own country, one's own cultural traditions, how we came to be what we are and how other cultures came to be what they are" (Allchin and Allchin 1997: 5). This is a goal which is most appropriate in the case of India with a proven record of cultural continuity across many hundred thousand years.

Allchin made his study of South Asia's past complete by publishing a fourth work of synthesis. *The Archaeology of Early Historic South Asia, published in 1995 with contributions* by Bridget Allchin, R. Coningham, George Erdosy and Dilip Chakrabarti, deals with the archaeological record of the early historical period which witnessed the rise of state formation including growth of cities (Allchin 1995). This period roughly spans from about the middle of the first millennium B.C. to the 3rd century A.D. and witnessed momentous developments including the rise of Buddhism and Jainism, growth of populous cities and city states, establishment of the first all-India empire by the Mauryan rulers, and spectacular growth of art and architecture. Wherever required, this book also makes use of ancient texts and inscriptional data as a supplement to mute archaeological evidence.

Among Allchin's other publications mention should be made of the three edited volumes of *A Source-book of Indian Archaeology* published consecutively in 1979, 1997 and 2003. These volumes were edited jointly with Dilip Chakrabarti and represent collections of important papers on various topics published by other workers in widely scattered journals and other works including some very early publications. These constitute a valuable and ready asset to research workers in South Asian archaeology. The first volume has a section devoted to the writings of early workers like Sir William Jones and Alexander Cunningham and the methods adopted in their investigations. The other sections have contributions relating to past environments, and domestic plants and animals. The second volume contains over 60 contributions covering the topics of settlement studies, ancient technology and trade. The third volume contains altogether 30 contributions. One deals with human skeletal record, three others with reconstruction of religious beliefs from the archaeological record and the rest are contributions of early workers dealing with aspects of historical archaeology such as art and architecture, numismatics and epigraphy.

Although rarely cited by workers, attention should also be drawn to Allchin's article on the historiography of Indian archaeology (Allchin 1961b). This is the only piece of writing on the subject which goes beyond narration of events and instead focuses attention on the intellectual environment of the four main phases in the development of Indian archaeology, viz. early period up to 1850; the Cunningham period; the Marshall period; and the period of Wheeler and thereafter.

Unlike in countries like Australia where heritage is considered as a kind of religion, the number of archaeologists in South Asia who attach importance to heritage management and preservation is unfortunately small. The Allchins fall in this limited class. In some of their books mentioned above they expressed concern about the destruction of ancient sites due to the initiation of various developmental programmes on the landscape in different areas. For example, they referred to the destruction of ancient sites like Taxila and Pataliputra caused by urban expansion, and loss of rock art near Bellary due to stone quarrying. Against this background, as part of India Festival in the U.K., they organized in 1982 a seminar on the topic of conservation in Cambridge, jointly with B.K. Thapar of Archaeological Survey of India. Many research papers were presented by senior scholars on both cultural and natural heritage and its preservation. They promptly published a volume entitled *Conservation of the Indian Heritage* (Allchin, Allchin and Thapar 1989). It has more than 20 papers dealing with various aspects of natural and cultural heritage including urban conservation, ancient sites, wild life and rainforests.

Allchin put to good use his proficiency in Sanskrit. In a short paper published in 1957 he traces the origin of the Sanskrit word eḍūka, meaning a chamber for depositing bones, and the Pali word eḍūka, meaning a relic chamber (Allchin 1957b). He believes that these two words have their root in Tamil *ritu* 'lay down, bury'. This word occurs in ancient Tamil texts too and, in Allchin's view, refers to stone cist burial. Stone cist burials correspond to and in fact may have served as models for raising the early stupas. Thus, in Allchin's opinion, both the Sanskrit and Pali words probably had their origins in the Tamil root *itu*.

Allchin's knowledge of Sanskrit also enabled him to appreciate the importance attached in the ancient Sanskrit texts to *pancha-gavya* or five products of the cow: milk, butter, curds, dung and urine. [Marvin Harris (1966) used precisely these attributes of the Indian cattle to explain why in India at some stage in the past ban was imposed on the slaughter of cattle for food purposes; and these animals came to be regarded as sacred in Hinduism.] This influenced Allchin's interpretation of ashmounds as the products of a Neolithic ash-fire cult. In fact *Cattle-Keepers* opens with a Sanskrit passage from *Bḍhajjābālopaniḍad*, which describes the positive qualities of ashes resulting from the dung of cows of five different colours, which emanated from five forms of Siva.

Allchin's deep respect to and appreciation of the spiritual and religious heritage of India found expression in another remarkable way. He used his knowledge of Hindi to translate into English two of the devotional writings of the well-known 17th century North Indian saint-poet Tulsidas, viz. *Kavitavali and Vinayapatrika* or petition to Ram. These translations were sponsored by the UNESCO as part of its programme to promote inter-cultural studies.

Support to South Asian Studies.

The Allchins did their best to promote in Europe studies in the early history and archaeology of South Asia. Jointly with the support of Sir Harold Bailey (Sanskritist), J.E.van Lohuizen-de Leeuw (Allchin's predecessor at Cambridge) and her husband Jan, they established the Ancient India and Iran Trust in Cambridge. From the private collections of books gifted by the founding Trustees, the Trust has built up an excellent library consisting of books, periodicals and photographic material. This library is widely used by scholars from Cambridge and other places. No less important, jointly with Wallace India Trust, the Trust gave financial support to many young scholars from India and other countries in South Asia to visit England for pursuing short-term research projects. Likewise scholars from Western Europe were provided financial support to undertake field research in South Asia.

The Allchins and van Lohuizen-de Leeuw promoted South Asian studies in other ways too.

They founded the European Association for South Asian Archaeology which holds biennial conferences. (It has recently been renamed as the European Association for South Asian Archaeology and Art.) It started with a small meeting in Churchill College in Cambridge in 1970. The first conference too was held there, followed by conferences at other places in Europe. The latest was held in Vienna in July 2010. The proceedings of these conferences have been published on a regular basis. These volumes constitute a rich source of information about recent developments in South Asian archaeology. Under the sponsorship of the Society for *South Asian Studies*, the Allchins also started in 1984 a new annual periodical called *South Asian Studies*, which has now emerged as a major international forum for publishing the results of ongoing research projects in South Asian archaeology and art.

Raymond Allchin was indeed cast in the mould of Sir William Jones who started it all by establishing the Asiatic Society in 1784 – the same innate curiosity about other lands and other peoples and their cultures, the same admiration for the heritage of Oriental peoples in the widest sense, the same zeal in initiating further inquiries into its origins and character, and the same noble aim of using heritage studies for building bridges across continents and peoples. Allchin also rightly recognized the pan-subcontinental unity of the Indian culture, while fully appreciating the existence of regional diversity within this wider geographical compass. He realized too the strong threads of continuity between the past and the present – a feature which carves a unique place for South Asia in the world. Above all, Raymond was one person who not only made a brilliant professional career out of the study of South Asia's long and rich heritage but engrained its ethos in his thought-stream. Indeed he is an iconic model to younger workers both in the East and the West engaged in *South Asian Studies*!

Public and academic awards are aplenty these days and are given to many people, deservedly or otherwise. Unfortunately, in Raymond Allchin's case, the recognition he received was not exactly commensurate with his achievements and noble *Weltanschauung*. For reasons best known to themselves Cambridge University could not promote him to the rank of a full professor. But in South Asia Raymond and Bridget Allchin received wide acclaim both for their deep scholarship and for their true love of this part of the world as an ancient region. Both of them had many students and friends in India and were always happy to visit them and update their knowledge of South Asian archaeology through these meetings. Indeed, they felt extremely happy at home during their visits to India, Pakistan and Sri Lanka. Both Raymond and Bridget visited the Deccan College in Pune on many occasions and always held the work of the late Prof. H.D. Sankalia and his colleagues and students in high esteem. They attended the four-yearly conference of the Indo-Pacific Prehistory Association (IPPA) which the Deccan College hosted in December 1978.

In 1996 the Indian Society for Prehistoric and Quaternary Studies elected Raymond to deliver the H.D. Sankalia Memorial Lecture, and Bridget as its President for the following year. They undertook the arduous road journey from Rishikesh to Srinagar (Garhwal) where the Annual Conference of the Society was held in 1997 under the auspices of the H.N. Bahuguna University. Even though they both were tired on arrival and hardly had any rest, they insisted on delivering their Addresses as scheduled in the afternoon of their arrival. Both these Addresses were highly appreciated by the participants (Allchin F.R. 1998; Allchin B. 1998). They took part in the proceedings of the conference for all the three days of its duration. Prof. K.P. Nautiyal, a former student of Prof. Sankalia, and Vice-Chancellor of the University provided excellent hospitality. Both Raymond and Bridget felt extremely happy with the smooth running of the conference proceedings, the warmth with which they were received and the scenic beauty of the Himalayas overlooking the sacred Alakananda river, one of the tributaries of the Ganga

At my suggestion as the Director the Management Council of the Deccan College (Deemed University) in Pune approved the award of the Honorary Degree of Doctor of Letters to Allchin. This Degree was conferred on him (*in absentia*) in December 2007.

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Book Reviews

Origins of Agriculture in Western Central Asia: An Environmental - Archaeological Study

David R. Harris

2010. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, pp. 304.

The origin of agriculture has been the subject of anthropological enquiry from a very early period in the history of the discipline. Discussions of agricultural origins in different parts of the world have been dominated by the concepts of primary or nuclear centres. It is generally assumed that hunter-gatherer initiated crop cultivation and animal breeding at these nuclear centres and from where agriculture and pastoralism later spread to secondary or non-centres. In addition, issues related to agricultural origins are generally framed and debated in terms of four questions: where, when, how and why. Although, there have been great advances in our understanding of agricultural origins in a few regions of the world, particularly the Southwest Asia, commonly known as "Fertile Crescent", there are many gaps in our understanding of agricultural beginning in the other regions. The present book brings one such area, the region of vast arid zone of Central Asia, into focus.

There had been little archaeological investigation of prehistoric agricultural settlements in the vast arid zone of Central Asia with the notable exception of southern Turkmenistan and parts of north-eastern Iran and north-western China. The site of Jeitun, situated on sparsely vegetated windblown sand at the southern edge of the Karakum desert, 28 km north-northwest of Ashgabat, was interpreted as the earliest site of Neolithic of Southern Turkmenistan on the basis of finds of a large number of flint sickle blades, small number of charred wheat and barley grains and their impressions on mud bricks, and of the bones of domestic goats and sheep. The site came to be regarded as the oldest agricultural settlement in Central Asia and gave rise to Neolithic Jeitun Culture. However, no systematic retrieval of plant remains by sieving and/or flotation was attempted and no radiocarbon dates on the samples from the site were obtained. Therefore, to fill the gap by adding new data to the earlier research undertaken in Turkmenistan and adjacent areas, an international project was carried out by a team of British archaeologists in collaboration with Russian and Turkmen colleagues between 1989 and 1998. Though, the site of Jeitun was the initial impetus of this work, the scope of the project, later on, expanded in two other regions- the middle Sumbar and Chandyr valleys and the Bolshoi Balkhan massif to elucidate the question of how agricultural communities originated on the piedmont. The present book, under review, is devoted to an account of the field work and analytical results of the surveys and excavations undertaken under the auspices of this international project. The book, in a way, set the results of this new research in the chronological and geographical context of the Neolithic period in western Central Asia as a whole. In addition, this book provides an introduction to the region for readers unfamiliar with its environments, ecology and early prehistory.

The book has five sections under different thematic heads. Part I of the book focuses on the physical environment and ecology of the Western Central Asia. The physiography, climate, vegetation and animal life of the region are outlined in the first chapter, while whatever is known about the changes in the region's hydrology, climate and vegetation during the Pleistocene and Holocene have been dealt in the second chapter. In the third and fourth chapter, the author shifts his attention to the local environment of Neolithic site of Jeitun, located at the junction of the Kopetdag piedmont and the Karakum desert and Bolshoi Balkhan sites situated close to the eastern coast of the Caspian. The discussion presented in these four chapters not only give an account of those geographical factors that have gone to make up the personality of the region but also provide a broad picture of the environment of the region and in a way set the scene for the other chapters that follow.

Part II of the book contains two chapters dealing with the prehistoric archaeology of the region. An outline of the history of the archaeological research from the late 19th century to the present is given in

Chapter 5, while Chapter 6 is concerned with an account of the main sites, archaeological sequences and subsistence economies of the Mesolithic and Neolithic periods. The historiography presented in these chapters are based on a comprehensive reading of the relevant Russian literature published in the former Soviet Union, as well as of the more limited body of work published by archaeologists from elsewhere who have worked in the region. These chapters, in a way, combine and form a synthesis of earlier Russian literature in a comprehensive manner. Such a strong synthesis of the earlier available archaeological data was absent in the literature so far due to the rivalry and lack of collaboration during the Soviet era between different institutes. A secondary reason for the lack of Soviet attempts to synthesise the data was the formulaic system of conducting archaeological research and interpreting archaeological data that was prescribed by Soviet ideology. This favoured, as the author also mentions (p. 43), the perception and study of archaeological sites and prehistoric cultures as separate entities and militated against attempts at regional synthesis.

Part III (Chapter 7) focuses more specifically on the crop plants and domestic animals that were present in Turkmenistan and adjacent areas during the Neolithic. These have been reviewed in order to appraise whether they are likely to have been domesticated in the region or introduced from somewhere else. One of the important aspects of this chapter is the incorporation of both cytological and molecular evidence into consideration while discussing the plants and animals that were present in the region. Researches on tracing ancient agriculture and pastoralism in recent years have revealed that cytological and molecular studies can provide another kind of evidence that can be used to evaluate hypotheses and raise new issues about the domestication of animals and plants. In particular, the analyses of modern and ancient DNA of several cereals and domestic herd animals that were part of earliest agricultural settlements can throw valuable light on the process of domestication. The review of archaeological, bio-geographical and genetic evidence concerning the areas of origin of the crops and domestic animals of Neolithic Turkmenistan and adjacent areas presented in this chapter reveals that very little is known about how they were incorporated into agricultural and pastoral systems that developed from *c.* 6000 BC. The author ends the chapter with a realization that it is difficult to reach well-founded conclusions, on the basis of the previous researches conducted in the region, about the central question of whether all the crops and domestic animals of the Jeitun Culture were introduced from elsewhere or whether some of them were domesticated independently in the region.

Part IV of the book has three chapters dealing with the recent investigations carried out by author and his team in Turkmenistan between 1989 and 1998. Chapter 8 begins with a detailed description of the excavations at the site of Jeitun. This section of the chapter is followed by short accounts of the surveys and test excavations carried out at several sites in the Sumbar and Chandyr valleys in the Kopetdag range, and in the Bolshoi Balkhan massif. Chapter 9 discusses the materials excavated and sampled at Jeitun. The radiocarbon chronology based on AMS (accelerator mass-spectrometric) established for Jeitun is described first, which established that Jeitun was a relatively short-lived settlement that was founded *c.* 6100 BC and lasted only for a few centuries. The settlement seems to grow larger and more complex in its short lifespan. This is followed by sections on sediments and soils, macro remains of wood charcoal, phytoliths and pollens, macro plant and animal remains, stone tools and pottery. These different sections are described by different authors who were part of the project team and undertook the analysis of these materials. The chapter ends with a summary discussion of the excavation evidence from Jeitun by the author and Chris Davis. Chapter 10 deals with the results of the materials excavated at the Dam Dam Cheshme rock shelters in the Bolshoi Balkhan. The chapter has been organised on the same lines as those were followed in chapter 9 and contains different sections contributed by different members of the project team.

Part V brings the book to a close with a synthesis and general conclusions, presented in two chapters. Chapter 11 offers a model about the nature of the Jeitun settlement and how it and other agro-pastoral settlements became established in western Central Asia during the Neolithic. The chapter begins with a discussion on the occupation and economy at Jeitun. The author then shifts his attention to the Jeitun culture as a whole, and then connections between it and other Neolithic sites in adjacent parts of Uzbekistan, Iran and Afganistan. The last section dealing with the evidence between the Jeitun Culture and other Neolithic sites raises interesting questions about possible interactions between agro-pastoral settlements and hunter-gatherer-fisher groups who may also have herded domestic livestock. To finish, Chapter 12 deals with the fundamental questions of how and why agriculture began in western Central Asia. The arguments made in this chapter are debated in relation to three themes: the biogeography of the Neolithic crops and domestic animals, the overall Neolithic settlement pattern and economy, and the role of environmental changes and cultural process in the establishment of settlements mainly dependent on cereal cultivation and livestock herding.

There are three models that can be applied to understand the origin of agro-pastoralism in any region. The first is the indigenous beginning of agro-pastoralism without the introductions of domesticated plants and animals from outside. The second is the indigenous-exogenous model which involves a combination of local domestication with the introduction and adoption of some taxa domesticated outside the region. The third is the exogenous model which involves the introduction of all the agro-pastoral domesticates from outsides. Harris applies all three models to define and asses the evidence of the circumstances in which agro-pastoralism began in western Central Asia, specifically in the piedmont zone of southern Turkmenistan. He rejects both indigenous and indigenous-exogenous models as there was no direct support for it in the multidisciplinary sources of evidence now available. On the other hand, he finds that the exogenous model suits well to define the origins of agriculture in western Central Asia. On the basis of this model, he proposes that the founder crops and herd animals cultivated and raised at Jeitun Culture settlements during the Neolithic were domesticated outside the region and introduced, either together as an already formed agro-pastoral 'package' or more intermittently over a longer period, or by a mixture of both processes. The plausible source of the domestic caprines, cattle and cereals, according to author (p. 232), could be Southwest Asia as there is no other potential source region of all these regions in north, south or east of Turkmenistan. However, one should not rule out the possibility that some hybridization or interbreeding could have taken place between domesticated and wild population of the cereals, sheep, goats and cattle as the domesticates spread eastward. In addition, no pre-Jeitun site has been found on the piedmont or in adjacent Kopetdag range and the question arises on the nature of interaction of incoming agro-pastoral settlers as there are no evidence of local Mesolithic hunter-gatherer-fisher. Though, the author gives the evidence of geometric micorliths as an indirect evidence of pre-Neolithic occupation at Jeitun and other Jeitun Culture sites, the subject deserves more systematic research.

One of the significant features of this book is the consideration of both plants and animals while discussing the origin of agriculture. Generally, anthropologists and archaeologists view herding and cultivation as separate activities and there are very few who attempt to synthesise and model agro-production system together. Animals are an integral part of agriculture and should not be studied in isolation as this book brings into focus. This book also brings into notice the significance of multi-disciplinary research in archaeological sites. Such multidisciplinary researches are still lacking in archaeological sites of the Indian sub-continent. Hopefully, this book will inspire a multidisciplinary approach for a full understanding of the archaeological sites in India also.

Adopting a novel approach to the subject of the origins of agricultures, the author examines it in terms of different disciplinary perspectives: ecological, geographical, social, archaeological, genetic and bimolecular. The author has succeeded in his aim to present this multi-disciplinary approach to investigate the issue in a large part of Central Asia, situated between the more fully investigated regions of early agriculture in Southwest and East China. As a book to examine the origins of agriculture in Western Central Asia, this major contribution is an important reading for archaeologists, anthropologists, biologists and geographers.

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Gandak Ghatime NBP Sanskriti ka udbhav avam Vikas

Arun Kumar (2010)
Patna: K.P. Jayaswal Research Institute.

The river Gandak is one of the major tributaries of the Ganga River. The Gandak Valley has been a place where ancient *Janapadas* of politically very powerful *Ganas* such as Licchvis flourished. These autonomous and freedom-loving people fought for a considerable time against imperial designs of the Magadha rulers. This historic geographical region also was populated during earlier periods. Sites such as Chirand, Chechar and Panr indicate the beginning of settled life during the Neolithic period followed by Chalcolithic settlements such as those at Manjhi and Hajipur. Arun Kumar, the author of this book has concentrated on NBP ware and sites related to this ware. The main focus has been on exploration and understanding settlement patterns in the Gandak Valley.

After discussing the physiographic and historical background of the area, in the third chapter, the author discusses in detail, explored and excavated sites. This is a very important documentation of sites, as it can further be used for intensive studies of the NBP period settlement archaeology. In the next chapter, the nomenclature, origin and extent of the NBP ware in North India is discussed. The relationship of the NBPW and other ware types such as Black-and-Red ware and Painted Grey Ware is highlighted. A discussion on fabric types of both monochrome and polychrome NBPW and the variations in colour is interesting. In addition to a detailed typology of NBPW shapes, the author has provided some information on other features of material culture of various NBPW sites. This enables the readers to understand overall picture of the settlements with NBPW tradition in the Gandak Valley.

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Conference Reports

"The 2nd International Symposium on Bifaces of the Lower and Middle Pleistocene of the World" "Les cultures à biface du Pléistocène inférieur et moyen dans le monde" Jeongok Prehistory Museum, Jeongok-ri, South Korea (30th April to 5th May, 2011)

The "2nd International Symposium on Bifaces of the Lower and Middle Pleistocene of the World" was held at Jeongok Prehistory Museum, Jeongok-ri, Gyeonggi-do, South Korea from 30th April to 5th May, 2011. This symposium was organized by the Jeongok Prehistory Museum and Gyeonggi Cultural Foundation, South Korea under the chairmanship of Kidong Bae and Henry de Lumley.

It is the second unique conference to be held on bifaces. The first symposium on 'Les cultures à biface du Pléistocène inférieur et moyen dans le monde' was organized in June 2007 at Tautavel, France by Institut de Paléontologie Humaine, Paris and Centre Européen de Recherches Préhistoriques de Tautavel under the presidency of Prof. Henry de Lumley who rightly perceived the need for an international symposium for discussion on various contentious issues which have been plaguing the World Acheulean.

There were around 30 participants from Spain, France, Germany, UK, China, Japan, India, Israel and US, besides South Korea. At this 2nd Acheulean symposium, the focus was on Asia with a number of participants from China, India, Japan, and South Korea.

The seminar combined discussions and presentations with site and museum visits. There were two days of intense academic discussions where the issues discussed ranged from terminology, lithic technology, regional variability, palaeoenvironment and geochronology to Movius hypothesis and human dispersals. The symposium began with an opening speech by Prof. Kidong Bae, Director of the Jeongok Prehistory Museum.

There were a number of interesting talks by scientists engaged in research on issues related to the bifaces. Of particular interest were several presentations by Chinese and Korean scholars (followed by museum and site visits and a look at biface collections from Jeongok-ri, Seokjang-ni and Suyanggae) which provided us with a better understanding of East Asian biface industries. Many of these scholars dwelled on the 'true Acheulean' or 'Acheulean like' or nature of these industries and the need for an appropriate terminology. "Non Acheulian handaxe" was one terminology suggested. Erika Bodin emphasized the distinctness of East Asian biface industries favoring perhaps a local origin for at least some of these assemblages from a common technical background or convergence phenomena.

Three participants from India attended this conference and were given a prominent place in the program with presentations in the first session. Ota, Deo and Mishra's presentation (presentation by Deo) was on the recently begun excavations at Tikoda, while Agarwal presented her work on the Lalitpur Acheulian assemblage and Mishra presented concepts on the Large Flake Acheulian.

A special Franco-Korean session highlighted new researches on the Korean Paleolithic, which included papers on Korean fossil hominids, biochronology, geochronology and lithic industry. Matsufuzi Kazuto discussed his attempts at formulating a local loess-paleosol chronostratigraphy for the biface sites in Korean peninsula and the Heshangdun Paleolithic site in China. He estimates a date of MIS 14 (568-528 ka) for the Mansuri site and MIS 8 to 5 for most other sites in Korea, comparable with the Dingcun industry of North China.

The sessions on the second day were devoted to Acheulean in Europe and Africa. Noteworthy, was a talk by Jack Harris wherein he tried to show similarities between Karari single platform cores and methods of LCT production during the Early Acheulean in Africa, thereby suggesting the possibility that Karari industries are transitional to (or precursors of) Early Acheulean in Africa. Robert Sala related his recent studies of rich Acheulean horizons at N'Gaous, Batna, Algeria and Oued Ar-Rabt, Oujda, Morocco in Western Maghreb which is already known for the famous sites of Ternifine in Algeria and Thomas Quarry in Morocco. Gowlett presented a very interesting paper on renewed investigations at Kilombe.

In another interesting talk, Naama Goren-Inbar stressed on flexibility observed in the Gesher Benot Ya'aqov (GBY) biface reduction sequence in the selection mode of different raw materials, percussor size and shift from hard to soft percussor and selection of blanks for different morphotypes like the scrapers. Ceri Shipton discussed the results of his statistical tests to understand how far resharpening affects our interpretation of biface shape.

At the valedictory session, issues of convergence/ diffusion and function of bifaces were highlighted.

During the symposium we had opportunity to visit many sites and museums in the South Korean peninsula as three full days were devoted to field trips.

The seminar was held at the newly constructed Jeongok Prehistory Museum. The museum building has been designed to merge with the natural surroundings. The exterior steel architecture has been impressively designed in the shape of the meandering Hantan river which glows at night like a moving reptile or UFO.

Words fall short to express appreciation for the museum interiors and the well designed and executed modern interactive exhibits and displays using latest digital technology. Of particular interest is the exhibit showcasing evolutionary 'Walk of Life' which depicts a reconstruction of 9 fossil men from Sahelanthropus to Homo sapiens along with a life size model of a mammoth, designed by a French specialist, Mme. E. Daynes. Other noteworthy exhibits included a mummy of the Ice Man 'Otzi', a reconstruction of Upper Paleolithic cave paintings from Lascaux, Chauvet and other caves in France, interactive exhibits of the lithophone, ground projection map of important earliest prehistoric sites in Africa, suspended balloon showing 'Out of Africa' dispersal, dioramic display on ecology and environment of Korea, an excellent virtual 3D reconstruction of the stratigraphy and context of the Jeongok-ri Paleolithic site and its past and present environments, digital morpheme of prehistoric faces, didactic videos on stone tool knapping, fire-making, experimental butchery and so on.

The museum has a special section for children's education where children can dabble with rock art or knapping stone tools. There is a vast open air exhibition space spread near the Jeongok-ri Paleolithic site which also has provisions for living archeology school dealing in activities like stone tool knapping, fire-making, butchery, pot-making, hut building, mock excavations, etc..

We also had a chance to visit the National Museum of Korea and Leeum Samsung Museum of Art. We must confess that we were awed by the museums in Korea and their well-executed exhibits.

The symposium concluded with the Jeongok Paleolithic festival, coinciding with Children's Day in South Korea. Prof. Kidong Bae and his team should be applauded for making it a huge success with a crowd of 60,000 people purchasing tickets to attend the festival. We need to learn a huge lesson from the organization of this festival as it has shown the path for fusion of heritage education or academic needs with social tourism.

The symposium was very well organized with every detail meticulously planned, right from the academic sessions, accommodation and food, to site and museum visits. The hospitality extended by the organizers was overwhelming. Particularly good care was taken to serve us a variety of Korean cuisine at different dining places each time.

From the Indian perspective, the emphasis on heritage management and education in South Korea was particularly amazing. We need to learn a lot from the well-designed South Korean museums, their interactive and well planned exhibits and didactic displays using state of the art technology and interest shown by the local people in their heritage.

We are already looking forward to the 3rd symposium to be held in Ethiopia, to discuss further the issues raised at this symposium.

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IGBP PAGES PHAROS Workshop: Land-cover reconstructions in the monsoon affected Tropical world - pollen modeling approach and data synthesis

This workshop was organized as part of the Golden Jubilee celebrations of the palynology laboratory of the French Institute of Pondicherry from January 27-29th, 2011 and was supported by PAGES. Very few workshops in India, in particular as related to environmental sciences, adopt a multidisciplinary perspective, and even fewer include archaeology and history as key subjects. It was this perspective that made this IGBP-PAGES PHAROS (http://www.pages.unibe.ch/science/foci/focus-4) workshop unique. Organised by Dr. Anupama Krishnamurthy, ably supported by her colleagues from the laboratory and students, this workshop was attended by over 50 delegates from India and abroad (Sri Lanka, Australia, Sweden, Estonia and France). A key feature was that in addition to the presence of senior research scholars, a substantial portion of the participants comprised doctoral and post-doctoral students. The workshop focused on land-cover reconstructions in the tropical world and issues were addressed through interpretations ranging from pollen modeling to data synthesis. The workshop comprised lectures, poster-sessions, discussion meetings as well as a field trip. As many delegates had brought posters, it was indeed good to see that special poster sessions were organised, whereby participants could spend time discussing and giving short talks on important data presented in their posters.

Key lectures included those on the European data synthesis and Sugita's Landscape Reconstruction Algorithm (LRA), Holocene time chronologies and vegetation history, modern forest ecosystems and archaeology and history of occupation of Peninsular India with a special focus on Tamil Nadu. Special sections dealt with approaches towards modeling and methodological issues in land cover reconstruction, including the need for Pollen Productivity Estimates (PPEs). Other topics covered included dynamic vegetation models, tools for spatial analyses, talks on the dry evergreen forests of South India and on the online Historical Atlas of south India. Papers by K.Anupama and other scientists (see IFP website for details), provided a perspective on the available data on palaeovegetation in South India and highlighted problems and perspectives in research trends. Compiled abstracts (http://www.ifpindia.org/ecrire/upload/meetings/abstracts_pages_2011.pdf) of talks, posters and presentations (http://www.ifpindia.org/ecrire/upload/meetings/pages_presentations_2011.zip) are available at the IFP website.

The multidisciplinary structure of the workshop enabled participants to obtain a long term perspective on human-land interactions, right from the Acheulian onwards. Participants from other fields could thus obtain a perspective on the data available from the South Asian archaeological record and assess its' importance in terms of modeling climate change. Papers were presented by Shanti Pappu, Kumar Akhilesh, K.Rajan, V.Selvakumar and Y. Subbarayulu on topics ranging from the Acheulian to the importance of epigraphy in reconstructing environmental history. A key aspect of the workshop was discussions which aimed at creating a multidisciplinary forum to bring together environmental scientists, palaeoecologists, archaeologists and historians.

The workshop ended with formation of teams to coordinate research in three major regions in India and Sri Lanka, with the purpose of examining issues related to both palynology and long term history. The section on Archeology and Paleoecology - syntheses and databases (proposed advisors and coordinators being S.Pappu, Y.Subbarayalu., T.R.Premathilake and K.D.Morrisson), focused on discussing long-term trends in environmental change in the context of human adaptation.

The field trip comprised a visit to the extraordinary and remarkable afforestation program run by the Sri Aurobindo International Centre of Education, which aptly illustrated land-cover changes and restoration ecology. The chance discovery of a few flakes and a core in this landscape also highlighted the importance of archaeology to delegates from other fields of research.

The workshop was excellently organized with ample opportunities for discussion. In particular, it was gratifying to see the importance assigned to archaeology. Based on feedback from participants there was no doubt that this workshop went a long way towards generating a serious awareness of the importance of Indian archaeology and history amongst scientists from environmental and earth sciences.

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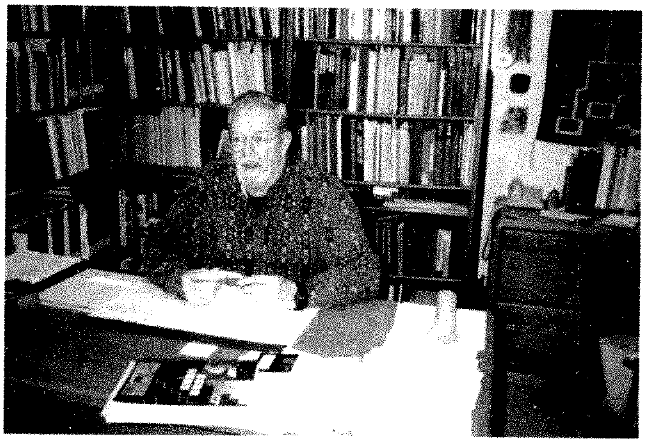
Obituary

Lewis Roberts Binford



(21 November 1931 - 11 April 2011)

Lewis Binford, known simply as Lew to scores of his friends and admirers the world over, suffered from heart-related ailments for a few weeks before peacefully breathing his last at his country home in Kirksville (Missouri) on 11 April 2011. By virtue of his many innovative contributions to the theoretical and methodological domains and on account of the giant-slaying episodes he was involved in, Binford strode archaeology like a colossus for half a century, as Gordon Childe did during the preceding half-century.

Lew was born in a coalminer family in Norfolk (Virginia) on 21 November 1931. After completing an undergraduate course in forestry and wildlife management, he underwent a stint of military service in East Asia. It was during this period that Lew picked up interest in observing simple societies. The desire to pursue this interest led him to enroll for a graduate course in anthropology at the University of North Carolina in 1954. There he soon realized that the diversity of human lifeways in the world as we see these now could not be understood without reference to their temporal context. So commenced his 'archaeology commitment' and to pursue it further he shifted to the University Michigan in Ann Arbor in 1956.

It was here that the quest for new ideas commenced for translating his commitment to archaeology into reality. In the introductory portions of the first of the three volumes containing his collected essays (*An Archaeological Perspective*, 1972; *Working at Archaeology*, 1983; and *Debating Archaeology*, 1989), Lew himself has given us many gripping details of the clash of ideas he was engaged in with a senior archaeologist like James Griffin as well as of the hardware (statistics) he received there from Albert Spaulding and the software (philosophy of science) obtained from Leslie White. While still pursuing his doctoral research Lew started teaching archaeology in Ann Arbor and then shifted to the University of Chicago as a faculty member. More combats in ideas followed, this time with Robert Braidwood regarding the whys and hows of food-producing revolution. And it was here that the spark of new ideas that had been generated in Ann Arbor developed into a full flame. With a band of enthusiastic supporters around him, Lew developed his propositions further into a manifesto and indeed Chicago served as the launching pad of the new movement. And the American Anthropology Association (AAA) symposium which Lew organized in Denver in 1965 fired the first shot in the public to announce the birth of new movement. Three years later Sally Binford and he brought out an edited volume containing the proceedings entitled *New Perspectives in Archaeology*.

Shortly thereafter Lew shifted to the University of California at Los Angeles where he inspired many young people including Mike Schiffer with his new ideas. In 1968 he moved to the University of New Mexico at Albuquerque where he stayed put for two decades. It was from here that he undertook ethnoarchaeological work among the Nunamiut Eskimos of Alaska and also developed themes like

Middle Range Theory. Then in 1991 he shifted to the University of Texas at Dallas, where he completed his last major publication entitled *Constructing Frames of Reference* and superannuated in 2000.

It will be unfair not to refer at all to the contribution of David Clarke of Cambridge University in connection with the emergence of New Archaeology. In his book *Analytical Archaeology* (1968) and the famous article of 1973 in *Antiquity* entitled 'Archaeology: The Loss of Innocence', Clarke was independently developing some of the core ideas. In his premature death archaeology has been robbed of one of its most fertile minds. Lew then became its sole torchbearer.

The label New Archaeology was a pejorative expression given by others, and Lew himself was content with characterizing his ideas as just New Perspectives. His proposition of archaeology as anthropology became the defining theme of New Archaeology and it is widely perceived that it effected a paradigm shift or revolution in the discipline. Lew developed this theme at length in his four core papers published between 1962 and 1968. The tenets of this new paradigm have now become an integral part of contemporary archaeological thought and deserve brief mention:

1. Conception of culture no longer as a mere list of items but as a structured system of interrelated components.
2. Taking cue from the old dictum 'Don't mistake trees for the forest', Lew laid stress on the recognition of interrelationships not only among various cultural components but between these and the surrounding natural and social environments. These interrelationships constitute culture process, which has become synonymous with New Archaeology.
3. Replacement of normative versions of culture by a functionalist orientation treating human cultures as extrasomatic means of man's adaptation to a given environmental setting. The inspiration for this was derived from functionalist anthropology via Leslie White.
4. Need to replace the traditional big-site approach to archaeological record by a regional research strategy. Lew is also credited with the introduction of probability sampling methods in field research and application of multivariate techniques for data analysis and pattern recognition.
5. In contrast with the traditional inductive approach to field archaeology, priority now is accorded to identification of problems of whys and hows of culture process by adopting the method of hypothesis testing.
6. All these changes were aimed to transform archaeology from what David Clarke called an 'undisciplined empirical discipline' bogged down to preparing descriptive accounts of antiquities and framing histories of cultural events and instead call attention to the anthropological goal of explaining similarities and differences in human cultural forms across space and time trajectories.

It is of course quite possible to locate one or the other of the above-mentioned propositions in the writings of previous archaeologists like C.J. Thomsen, Gordon Childe, Walter Taylor and Grahame Clark but these remained at the level of isolated references only and never formed a unified theme. It is the New Archaeology which brought them together under one label and showcased them as a manifesto.

Coming to substantive studies, Lew's reinterpretations of the meanings of hunter-gatherer sites served as another propellant that shot him into fame. Readers will recall the epic clashes that took place in 1967 between Lew and his wife Sally on one side and the famous French prehistorian François Bordes on the other about the meanings of five variants found by him within the Mousterian of Southwest France. Employing Factor Analysis, they mounted objections to Bordes's theory equating the assemblages with ethnic groups. Instead they put forward the famous functional argument which sought to relate assemblage variability to functional variability, which in turn is guided by seasonal variability in resources availability (Binford and Binford 1966).

Soon Lew boldly extended this argument to account for variability in the Late Acheulian assemblages from Olorgesailie, Kalambo Falls and other sites in Africa (Binford 1972). A decade later he used this strategy and re-examined the faunal collections from Olduvai Gorge localities from the point of view of bone taphonomy and arrived at the startling conclusion that the early hominins, far from being mighty hunters, were only scavengers of left-overs of meat from carnivore kill sites (Binford 1982). These studies provided much stimulus to research in bone taphonomy and hominin dietary patterns.

The Mousterian debate made Lew realize the need for analogies arising from observation of actual functioning of living hunter-gatherer groups. Thus came up his four-year-long (1969 to 1973) field research among the Nunamiut Eskimos of Alaska. This was the first ever systematic archaeological study of a living hunter-gatherer society and the resultant monograph set a model for work in this branch of archaeology (Binford 1978). Lew's pattern-seeking mindset led him to consider his Nunamiut research in the context of other well-known hunter-gatherer groups of the world. Based upon this comparative study he proposed the well-known forager versus collector model of hunter-gatherer settlement systems (Binford 1980). This settlement system model is one of his lasting contributions to archaeology and, with suitable modifications, is useful for studying even agropastoral and other advanced communities.

Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building - Using Ethnographic and Environmental Data Sets, published in 2001, marks the pinnacle of Lew's comparative ethnoarchaeological research on hunter-gatherer societies. It is a work of monumental proportions, encompassing 340 simple societies spread all across the globe and environmental data obtained from 1400 weather stations and a large number of wildlife sanctuaries. It is a true treasure-house of lower, middle and higher order generalizations about the structure and functioning of hunter-gatherer groups. While putting a bolder stamp on his settlement system model, this work also marks Lew's realization of his graduate-time goal of explaining diversity among the simple societies of the world through the lens of archaeologist and with the use of ecosystem-based research strategy of adaptation. His initial training in forestry and wildlife management was surely not without benefit in this whole endeavour.

I am happy to record that Lew had close contacts with the Deccan College in Pune for a full quarter-century. H.D. Sankalia's book *New Archaeology: Its Scope and Application to India* (1977) had already introduced us to the ideas of New Archaeology. But it was in the middle of 1986 that we had a chance to hear about it from horse's mouth, as it were. Under the leadership of M.K. Dhavalikar the Institute organized a Summer School in New Archaeology in May-June 1986. A Ford Foundation grant enabled the Institute to invite Lew as the key resource person to deliver a series of lectures. Lew and his wife Nancy Stone spent nearly four weeks in Pune, happily interacting with and inspiring one and all. This was the effective beginning of New Archaeology in the country.

The Summer School was attended by some 30 young teachers and research workers drawn from all across the country. Many of them later came to occupy or still occupy important positions in the discipline and fondly recall the inspiration they received from Lew's long lectures, each clocking two hours and more. These were illustrated with 35 mm slides and were heard with rapt attention, sometimes creating in the minds of participants the illusion that they were seeing the Nunamiut Eskimos themselves at work or the caribou on their seasonal migratory paths. There were occasions of commotion too, as for instance when a query was put to Lew by one of the participants whether reliable knowledge about the past was possible at all. This brought out the element of fury in Lew and he exploded: "If you don't believe in it, then leave archaeology and do something else!" Lew's tall academic stature and his imposing physical frame, coupled with Nancy's charm, made them into an adorable pair with one and all.

Lew had happy meetings with H.D. Sankalia, who had the distinction of being one among a small number of persons outside the Anglo-American world to advocate the cause of New Archaeology soon after its emergence. On one informal occasion Lew expressed his admiration for Sankalia's various contributions and called him the Abbé Breuil of Indian Prehistory! As part of their stay Lew and Nancy visited several important archaeological sites in the country. Dhavalikar and M.S. Mate took them to Inamgaon, Ajanta and Ellora. V.N. Misra showed them the Bhimbetka caves. Lew also visited the Archaeological Survey of India, New Delhi and delivered a lecture there. I had an occasion to take them to Hunsgi valley in Karnataka. Walking on many surface or near-surface Acheulian localities there, Lew called these deflation surfaces. We tested this proposition in subsequent fieldwork and found at Isampur and other places the Acheulian level still buried under 2 m thick silt-deposit! Lew's links with the Deccan College lasted till the last days of his life. He not only published three of his papers here (Binford 1990, 2002, 2007) but included copious references to the ethnoarchaeological researches of V.N. Misra, M.L.K. Murty, Zarine Cooper and others in his monograph *Constructing Frames of Reference*. I published a review essay on it in *Man and Environment* (Volume 34(2), 2009). I had earlier reviewed his other book *In Pursuit of the Past:Decoding the Archeological Record* (Paddayya 1986).

My personal interaction with Lew become closer during my two visits to the U.S. as a Fulbright Fellow. In 1987 I co-taught with him a course on the Asian Palaeolithic at the University of New Mexico, Albuquerque. I also had a chance of auditing his highly acclaimed lectures as part of the course on Strategies in Archaeology. Then I visited him in 1999 at the Southern Methodist University in Dallas and gave a lecture on the Isampur excavation. I stayed with Nancy and Lew on both occasions and they played warm hosts. In Lew's death I truly feel the loss of a good friend, an inspiring guide and teacher, and a true generator of ideas.

Now that he is no more with us, people will be tempted to ask: Where do Binford and his contributions to archaeology stand in relation to 'newer' perspectives that came up in New Archaeology itself in the 1970's and the ideational or interpretive perspectives that started coming up from the early 1980s? The frontispiece drawing in the book *Symbolic and Structural Archaeology* (1982), edited by Ian Hodder, caricatured Lew's inability to diagnose problems of modern archaeology with his physician's tool-kit of Middle Range Theory. Some even pronounced the death of New Archaeology. But knowledge formation is not so much about births and deaths of ideas but is rather concerned with their ebbs and flows. If we accept the basic premise that archaeology is an empirical science that seeks to create knowledge about the past human societies from archaeological record, then Lew's basic formulations of anthropological archaeology are difficult to challenge. Since archaeology is a cultural empirical science, it can at the same time ignore neither approaches to extract ideas or notions in human mind that generate behaviour nor the larger societal dimensions of the study of the past. These hard and soft (my words for processual and post-processual orientations) approaches and, for that matter, traditional culture history approaches are not mutually exclusive but go hand in hand; their applicability varies from area to area and from problem to problem. In this context it is heartening to see a senior person like Ian Hodder himself calling for an integrated approach for decoding what he calls 'human-thing entanglement' in the past (Hodder 2011).

So it appears that although the living legend that Lew was has now entered portals of history, his legacy will live on. Lew's message to students, as contained in the preface to the paperback edition of his book *Debating Archaeology*, sums up well this legacy, '.....remember that science studies classes of phenomema and that shifting scales of observation and comparison are valuable strategies for learning under what conditions generalizations hold or fall apart. Studying classes of phenomena implies the importance of comparing cases within classes and one class to others in order to specify the structural relationships among dimensionalized variables which contribute to variation within and among the phenomena we study. Shifting scales implies that we must learn how variation in particular time and place relates to variation across more time and space. Remember any site, no matter how well documented, is a tiny artifact of past dynamics. Being able to think about sites and settlement systems in the contxt of where they fit in the range of variation that is archaeologically and ethnographically known helps us to focus on the questions of interest to the broadest field of anthropology (Binford 2009:xiv).

Lew received honorary degrees from the universities of Southampton (1983) and Leiden (2000), a medal from the Royal Anthropological Institute in London (1986) and a lifetime achievement award from the Society for American Archaeology (2008). Pei-Lin and Mathew Schmader organized a symposium on "Archaeology is Anthropology: Celebrating 50 years with Lewis Binford" as part of the Annual Conference of the Society for American Archaeology held in St. Louis in 2010. Now the Society has created an endowment called Binford Memorial Fund for promoting research in scientific reasoning. This is a fitting tribute to the memory of a person who championed with tremendous success the cause of reasoned research and writing in archaeology.

Lew was a skilled draughtsman and most of the illustrations printed in his publications are his own works. He was skilled in carpentry too and designed and built a whole wooden house for his mother-in-law near Albuquerque. Lew is survived by his wife Dr. Amber Johnson and daughter Martha Binford.

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Statement about ownership and other particulars about periodical to be published in the first issue very year after the last day of February.

FORM IV

1. Place of publication : c/o Department of Archaeology
Deccan College, Pune 411 006

2. Periodicity of its publication : Half yearly

3. Printer's Name : Mr. Sujit Patwardhan
Nationality : Indian
Address : Mudra, 383 Narayan Peth, Pune 411 030.

4. Publisher's Name : Dr. P.P. Joglekar
Nationality : Indian
Address : 355 Jadhav Nagar, Vadgaon (Bk),
Pune 411 041

5. Editor's Name : Dr. V.N. Misra
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1st March 2011

P.P. Joglekar

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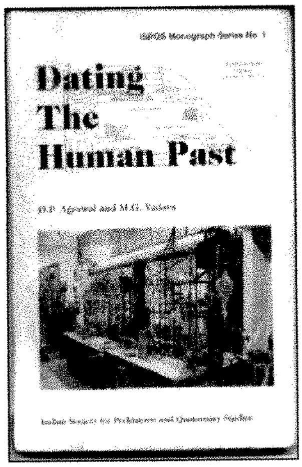
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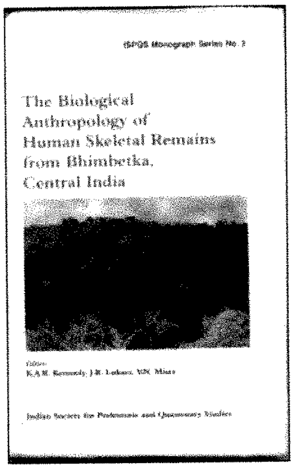
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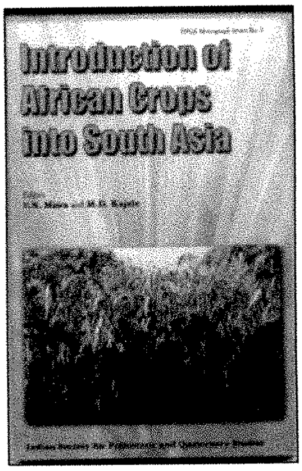
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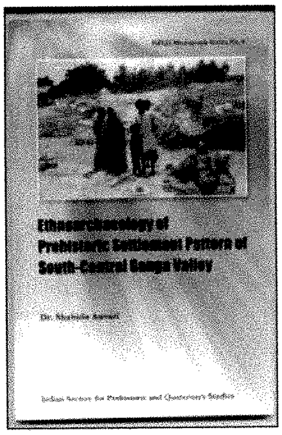
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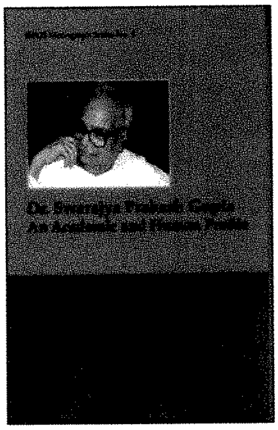

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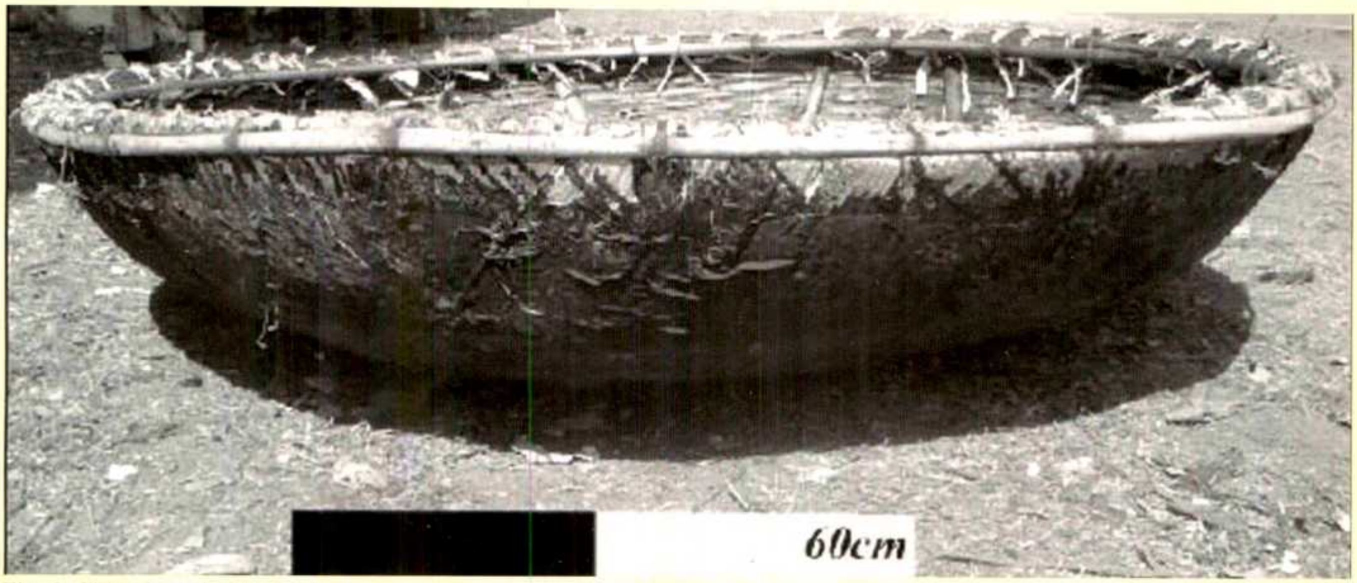

Fig. 2. Side view of skin boat

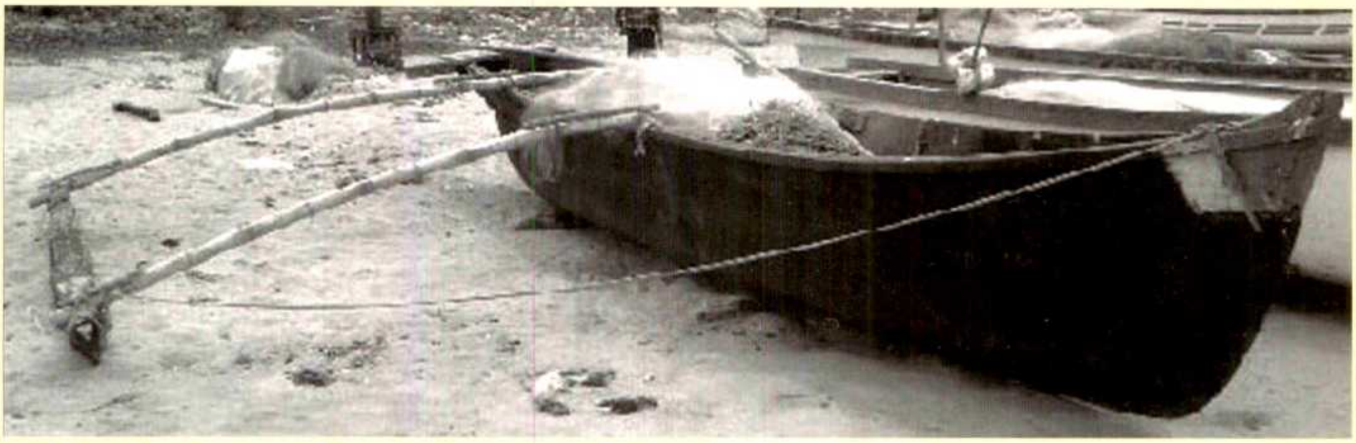

Fig. 4. Side view of extended dugout with outrigger (2 / 3 strakes)

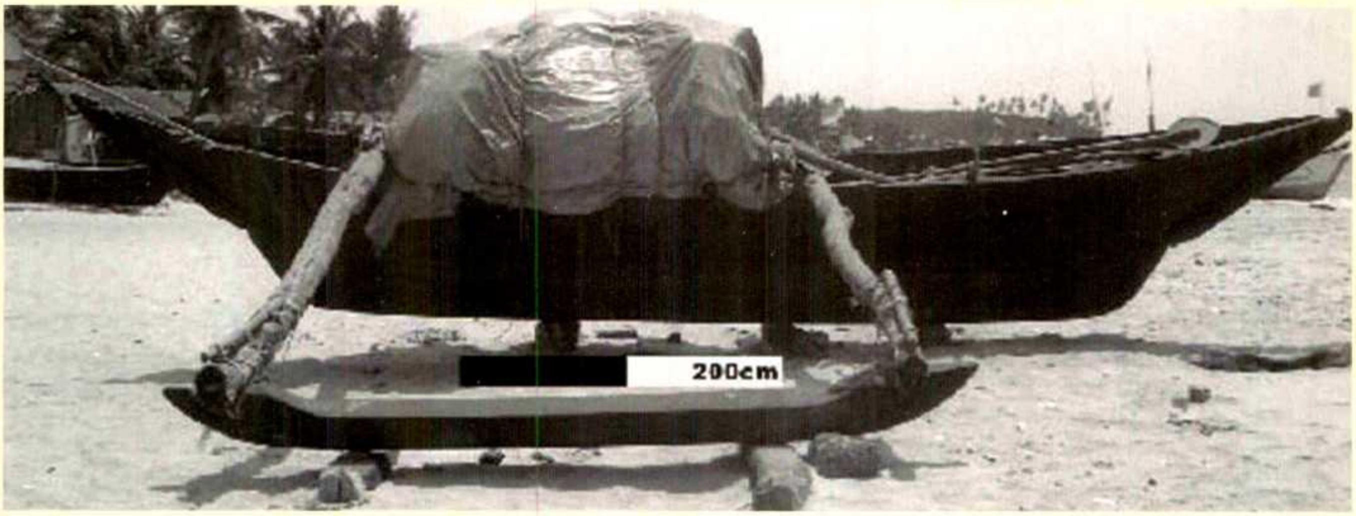

Fig. 5. Side view of extended dugouts with outrigger (3 strakes)

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Volume XXXVI, No. 1 (January-June 2011) ISSN: 0258-0446

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Publisher
Indian Society for Prehistoric and Quaternary Studies
c/o Department of Archaeology
Deccan College, Pune 411 006

Printer
Mudra
383 Narayan Peth,
Pune 411 030

Price: Rs. 800.00

Vol. XXXVI, No. 2, 2011

Man and Environment

Indian Society for Prehistoric and Quaternary Studies

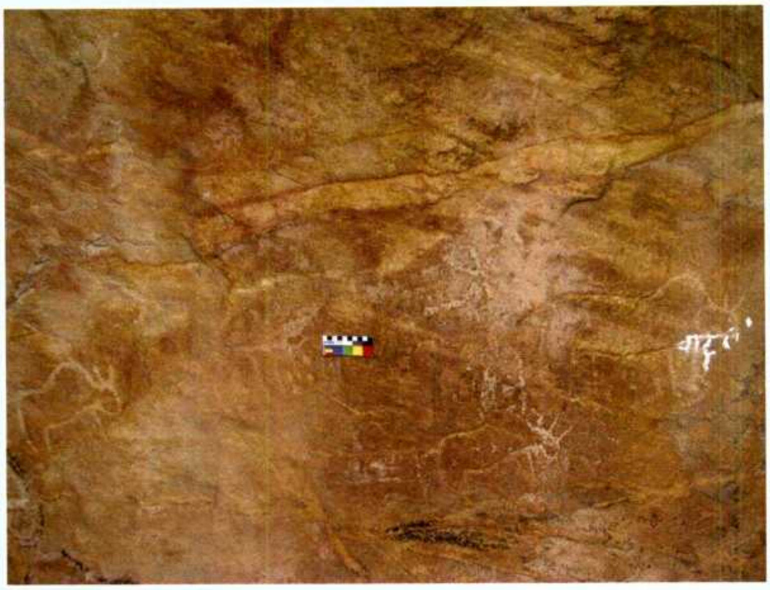
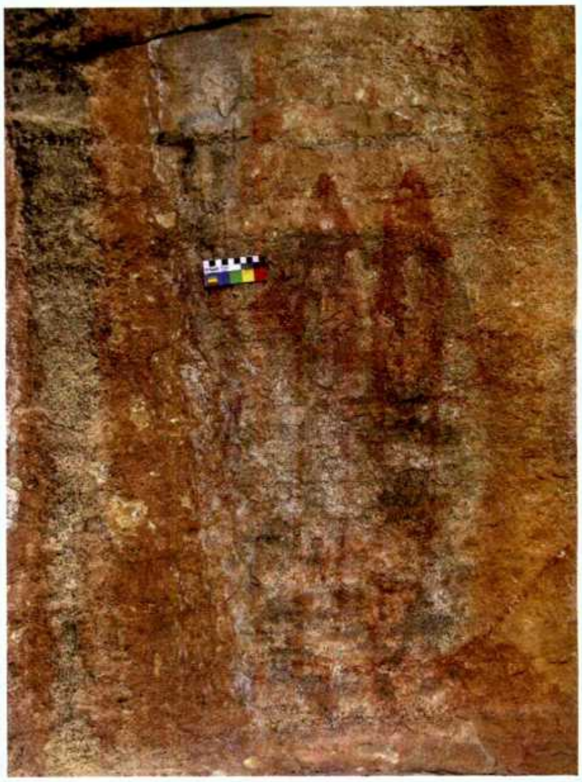


Fig. 5: Engravings of humped bull inside P.R.S. 1



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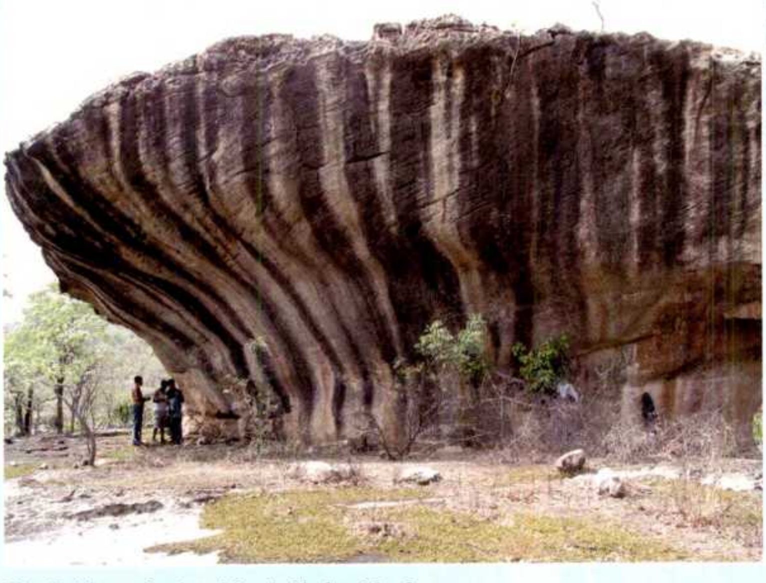

Fig. 7: View of painted Rock Shelter No. 2

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Man and Environment

Journal of the Indian Society for Prehistoric and Quaternary Studies

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Shanti Pappu

Editorial

This issue of the journal continues to provide a diverse array of research articles from scholars in India and abroad. In addition to the articles we have several book reviews.

The first article by Professor Paddayya is a revised version of the Professor H.D. Sankalia Memorial Lecture delivered at the 38th Annual Conference of the Indian Society for Prehistoric and Quaternary Studies hosted by the University of Lucknow, Lucknow, December 2010.

Hossein Negaresh and his colleagues from Iran discuss the structure and morphology of raised beaches in Southeastern Iran. Samanti Kulatilake discusses craniometric variation observed among South Asians in connection with the origin and dispersal of modern humans and history of South Asia.

Chanchala Srivastava and D.P. Tewari from Lucknow present palaeoethnobotanical findings from a Kushana period site of Naimisharanya in Uttar Pradesh. We have an article on rock art from Madhya Pradesh. Kantikumar Pawar and his co-workers describe painted rock shelters at Dharul, in the Upper Tapi Basin. A.S. Gaur and his colleagues report the findings of the excavations at Kanjetar and Kaj on the Saurashtra Coast, Gujarat.

There are three articles related to archaeological survey: Narender Parmar's archaeological Investigations in Southern Haryana; Vivek Dangi's report on explorations along the Ghaggar River and Sirhind Nala in Haryana and Punjab; and a preliminary report of settlement survey conducted in 2010 along the Ghaggar and its hinterland by R.N. Singh and others. Sila Tripati and his associates discuss utility of the Chinese porcelain sherds recovered from Old Goa as indicators of trade contacts.

The Society lost a well respected and dedicated life member, Dr. Malti Nagar. She has generously supported awards in the field of ethnoarchaeology and was actively involved in all society meetings. The editorial board deeply regrets her loss.

The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and the Archaeological Survey of India (ASI). The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR, ASI and the Indian Society for Prehistoric and Quaternary Studies accept no responsibility for them.

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The Society publishes its bi-annual Journal (June and December) *Man and Environment*. This journal publishes recent and *original* research in the field of South Asian archaeology, including related topics in environmental, anthropological and historical disciplines. The journal has five types of contributions: research articles, short notes, review articles, obituaries, and seminar and conference news. Books are welcome for reviews. The editors will send the book to suitable scholars to be reviewed. All articles submitted for publication are sent to referees. Authors will be asked to revise their manuscripts in the light of these comments. Acceptance of the manuscript will mainly depend on the opinion of the referees.

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Cover: Chinese Ceramic sherd from Old Goa.

Paddayya, K., *Man and Environment* XXXVI(2): 01-19 [2011].
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Newer Perspectives in the Investigation of Early Agro-pastoral Cultures of India*

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> "*There is joy or delight not only in having this knowledge (about the past), but in its very pursuit.*"
> (Sankalia 1965: 31)

Introduction

The above statement with which Professor Sankalia concluded his widely read popular book entitled *An Introduction to Archaeology*, while it succinctly sums up the whole task of archaeology, also reflects his own love for the discipline and ceaseless quest for unravelling the past. Sankalia's personality and his writings continue to be an unfailing source of both fascination and inspiration. No effort is too large to salute his memory. He was an *Acharya* in the true sense of the term and was not only born for archaeology but breathed it till his last moments.

I am grateful to the Executive Committee of the Indian Society for Prehistoric and Quaternary Studies for inviting me to deliver this special lecture instituted for perpetuating Sankalia's memory. I readily accepted this invitation for two reasons, both involving Lucknow city. First, my first research paper as a doctoral student, reporting the discovery of a Mesolithic site in North Karnataka, was published from Lucknow in 1967. I remain ever indebted to the Ethnographic and Folk Culture Society for readily publishing it in their reputed journal *The Eastern Anthropologist* (Paddayya 1967). This served as a great source of encouragement to me as a young research scholar.

Secondly, and more importantly, in this very city Sankalia himself delivered in 1974, exactly 36 years ago, the prestigious D.N. Majumdar Memorial Lectures under the auspices of the Ethnographic and Folk Culture Society. These lectures were a virtual wake-up call to Indian archaeologists to improve matters in the domain of theoretical archaeology. In tune with his restless mind and quest for new ideas, he selected as his theme the New Archaeology which had just emerged on the academic horizon in the Anglo-American world. Later these lectures (two in number) were published as a book entitled *New Archaeology: Its Scope and Application to India* (Sankalia 1977a).

Stated briefly, in the first lecture Sankalia referred to the major changes that had come up in archaeology after World War II, particularly the employment of various scientific techniques and the shift of emphasis from artefacts to reconstruction of past lifeways. He then examined the main themes broached in David Clarke's book *Analytical Archaeology* and the volume *New Perspectives in Archaeology* edited by Sally and Lewis Binford, both of which had appeared in 1968 and marked a paradigm shift in archaeological theory and method. In the second lecture Sankalia argued for the use of these perspectives in Indian prehistory, protohistory and historical archaeology. In particular he emphasized the relevance of contextual and functional approaches to archaeological record and the use of analogies drawn from experimental and ethnographic studies. Sankalia concluded the two lectures by calling upon "our students and colleagues to come forward to adopt newer methods and techniques, and refine them further so that we know as much of Man as possible" (Sankalia 1977a: 98).

I take inspiration from this statement made by Sankalia and also from his oft-repeated exhortation to his students and colleagues at the Deccan College "Never stop learning!" and would like to suggest in this lecture some improvements in the investigation of early agro-pastoral societies of India. The main argument I wish to put forward is that our current understanding of the archaeological record of this very crucial phase of India's past, covering the third and second millennia B.C., is by and large descriptive in nature and that we need to elevate it to an explanatory level so as to enable us to discern the organizational diversity that existed in these cultures at the regional and sub-regional levels. In short, it is being advocated that the adaptational and ideational domains of these cultures need to be addressed by perspectives drawn from both processual archaeology and post-processual trends.

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* H.D. Sankalia Memorial Lecture delivered at the 38th Annual Conference of the Indian Society for Prehistoric and Quaternary Studies hosted by the University of Lucknow, Lucknow, December 2010.

Status of Research on the Early Agro-pastoral Cultures

We can legitimately be proud of the fact that the Dark Age in Indian history, which Sir Mortimer Wheeler bemoaned while leaving India in 1948 as the head of the Archaeological Survey of India (Wheeler 1949), has now been filled up with a number of culture complexes which are variously called Neolithic or Chalcolithic or grouped under the hyphenated designation Neolithic-Chalcolithic, depending upon the use of copper or its absence. More importantly, irrespective of the use of different designations, these cultures truly fulfill Gordon Childe's famous definition of the Neolithic as the era of self-sufficing food-producing economy. All of them are characterized by settled life, domestication of animals and cultivation of crops, practice of burial of the dead, and pottery and other crafts and arts. The principal cultures known thus far are as follows:

1. Trans-Indus basin Neolithic complex centered in northern Pakistan.
2. Kashmir valley Neolithic culture.
3. Ahar or Banas and Ganeshwar-Jodhpura cultures of Rajasthan.
4. Pre-Indus Chalcolithic cultures of Gujarat.
5. Late Harappan cultures of the Indo-Gangetic divide.
6. The Kayatha and Malwa cultures of Central India.
7. Late Harappan, Black-and-Red ware, Ochre-Coloured Pottery/Copper Hoards complex, Narahan and Chirand cultures of the upper and middle reaches of the Ganga Basin.
8. Neolithic culture of the North Central Vindhyas.
9. Chalcolithic culture of the Ajay valley in the lower Ganga basin.
10. Neolithic complex of Northeast India.
11. Neolithic complex of coastal Orissa.
12. South Indian Neolithic culture.
13. Savalda and Jorwe cultures of northern Deccan.

Over and above these culture complexes, there are two instances of early agro-pastoral way of life in the Indian subcontinent, both dated to the seventh millennium B.C. One of these refers to the site of Mehrgarh in Baluchistan where prolonged excavations exposed evidence of settled village way of life characterized by wheat and barley agriculture and cattle and sheep husbandry (Jarrige *et al.* 1995). In the eastern part of the Ganga plains, excavations at Lahuradeva in Sant Kabir Nagar district of Uttar Pradesh exposed evidence of exploitation of wild or domesticated species of rice (Tewari *et al.* 2003).

The recognition of these cultures surely ranks as one of the major achievements of post-Independence archaeology. A voluminous body of literature comprising both site-reports and research papers has accumulated on this topic (for general reviews, see Sankalia 1974, 1977b; Thapar 1985; Allchin and Allchin 1968, 1982, 1997; Agrawal and Chakrabarti 1979; Agrawal 1982; Dhavalikar 1997; Agrawal and Kharakwal 2002; Chakrabarti 2006; Tripathi 2009; R.P. Singh 2010; P. Singh 2010). Some reviews of the faunal and plant remains forming part of the archaeological record of these cultures are also available (e.g. Kajale 1991; Thomas 2002; Fuller 2006). But the issue is one of the level of our understanding of these cultures. We have only a handful of studies which treat the archaeological record of these cultures in a regional framework oriented in terms of geographical features. Raymond Allchin's (1963) study of the Neolithic ashmounds of southern Deccan and Dhavalikar's (1988) synthesis of the Chalcolithic phase of northern Deccan come immediately to one's mind. In an interesting recent study Weber *et al.* (2010) have pointed out that distinct ecological zones, distinguished from one another in terms of soils, moisture and climatic factors, existed in northwestern India ever since the Harappan times and that this ecological variability in turn promoted agricultural diversity. There are a few other studies which have been undertaken at a much restricted regional scale (e.g. Lal 1984; Panja 1996; Shinde 1998; Venkatasubbaiah 2007; Singh *et al.* 2010).

. Barring some exceptions like these, the publications are content with giving us details about site location, stratigraphy, and cultural record comprising pottery, stone tool assemblages, terracotta objects and ornaments like beads of semi-precious stones and other materials. Some of the publications also provide lists of plants and animals, the remains of which have been found as part of the site archaeological record. These studies end with a formal note of conclusion highlighting the importance of the site or group of sites for filling up gaps in the archaeological record of the area concerned. This is knowledge of the natural history stage without which one cannot comprehend the general framework of cultures in a given region. But this information is not of much help when we seek to understand the functioning or working of these cultures. In other words, we need to elevate these studies from the descriptive and classificatory state to an explanatory level, which in turn entails a reorientation of the principal research perspectives. This shift in research focus calls for to a two-fold approach. First, efforts need to be made to relate these cultures to their respective landscape settings in order to recognize their respective organizational identities. Secondly, we need to recognize that in the case of some of these cultures, spread as they are over large expanses of territory, quite some variability could exist even at the sub-regional level.

Clues from Ethnography and Geography

What I mean to say is best illustrated by an argument which I often used in classroom discussions. I used to say that a visiting American tourist would find on the Indian rural landscape a large degree of cultural monotony – villages or hamlets strewn on the landscape without any formal layout; dwelling houses made up of wood and mud that need to be repaired or replaced every few years; simple ceramics and other function-oriented items of material culture equipment; small or large herds of cattle or sheep/goats returning to villages by dusk from grazing grounds; hilly tracts alternating with stretches of plain land supporting rain fed-crops of cereals and pulses and involving simple animal-drawn agricultural implements; and the same *saree* and *dhoti* worn by women and men. But a visiting cultural anthropologist, as I used to remind students, would notice on the some rural landscape a great spectacle of cultural diversity, each region with its own complement of individualistic traits well suited to the respective regional landscape setting – be it the hilly, plainland or coastal landscapes selected for occupation; large differences in rainfall; differences in the crops or animals that are raised and hence subtle but noteworthy differences in food habits; differences in types of dwelling houses and modes of their construction depending upon amount of rainfall and raw material availability; differences in ceramics and other material culture items; and, of course, linguistic and ethnic diversity.

In fact, one need not wait for an American anthropologist to draw attention to this tremendous diversity on the Indian rural landscape. It has already been commented upon by both anthropologists and geographers in India. In a very perceptive essay entitled 'The Cultural Zones of India' originally published in 1956, N.K. Bose, after discussing various possibilities of dividing India into zones on the basis of geographical, linguistic and racial features, attempted to divide it on cultural criteria. Adopting a Tylorian definition, Bose stated that culture "covers everything from the traditional manner in which people produce, cook or eat their food, the way in which they plan and build their houses, and arrange them on the surface of the land; the manner in which men are organized into communities, to the moral or religious values which are found acceptable, on to the habitual methods by means of which satisfaction is gained in respect of the higher qualities of the mind" (Bose 1967: 15). He further pointed out that tangible culture items and practices could be mapped across space, from which one could draw historical inferences about human migration and diffusion of cultural practices. Bose hinted that maps could be prepared by using cultural practices like traditional methods of food preparation, mode of offerings to gods and ancestors, wearing of garments in everyday life or on ceremonial occasions, and implements of daily use. He considered such maps as important aids to methods of historical research. He even went to the extent of saying that findings of archaeology could be used to strengthen these ethnographic observations (Bose 1967: 16). Another important observation made by Bose should alert archaeologists. That is, cultural items of day-to-day use change but extremely slowly irrespective of the major changes that may take place in the economic, political and military conditions of the society at large.

After these preliminary observations, Bose cites some important items of daily life for recognizing cultural zones in India (Bose 1967: 18-20). Rice forms the staple food item in a large area covering northeast India, Bengal, coastal tracts of Andhra and Tamil Nadu, and entire Kerala. Millets (*jowar* and *bajra*) in the form of bread are commonly consumed in north Karnataka, Telangana, Maharashtra and Gujarat. As against these food-zones, wheat bread is common in north India with sub-regional differences as according to cooking or eating methods. Bose recognized regional patterns in cooking oils too. Mustard oil is commonly used in Uttar Pradesh, northeast India, Bengal and parts of Bihar and Orissa. In Andhra, north Tamil Nadu and Maharashtra sesame oil is common, while groundnut and coconut oils are the main cooking media in south Tamil Nadu and Kerala. He also recognized differences in the devices used for oil-processing, with or no provision for a drain-hole at the bottom. There are regional patterns in garments also. Bose pointed out that unsewn garments like *dhoti* and *chadar* are common in Bengal and eastern India, and the use of sewn garments increases as one proceeds westwards. There are interesting regional patterns in the use of *dhoti* and footwear too.

Bose pursued this topic of regional diversity in rural India further and brought out an edited volume entitled *Peasant Life in India: A Study in Unity and Diversity* in 1961 (Bose 2009). This volume has many interesting essays giving information about regional variations in village form, dwelling types, dietary habits, agricultural implements, dress and footwear. In his introduction to the volume, Bose makes the interesting observation that there is more differentiation at the material aspects of life and relatively less of it in non-material aspects spheres.

As an extension of Bose's work on peasant cultures, Saraswati and Behura (1966) undertook a detailed survey of pottery-making techniques followed in rural India. Their investigations, covering 306 production centres spread over 143 districts representing different parts of India, brought to light interesting diversity in the production of ceramics – variety in the clays used, hand-moulding and wheel techniques, and vessel shapes and painted decorations. Archaeologists have much to gain from this volume also.

This regional cultural variability is to a large extent governed by geographical factors; it is this topic which the present paper wants to focus attention on. Regionalism is a well-known concept in Indian geography. Over and above the recognition of three major zones comprising the Himalayan belt, Indo-Gangetic plains and peninsular block, many attempts have been made by geographers to recognize regions within these broad zones. As pointed out by Spate and Learmonth, there is no universal criterion for identifying regions. In their own words: "A metaphysical dubiety may surround the whole concept of 'the region,' but for practical purposes regions exist, and if they did not they would have to be invented to obtain manageable units of study" (Spate and Learmonth 1957: 410). From the early part of the last century onwards scholars like Dudley Stamp (1928), F.J. Richards (1933) and others divided the country into different zones using multiple geographical factors. Using the criteria of structure, physiography and climate, Dudley Stamp (1928) recognized three primary regions and 22 subregions.

Spate and Learmonth (1957), proceeding from the premise of the existence of three paramount regions on the basis of structure, recognized 35 regions of first order and 74 regions of second order, with a total of 225 subdivisions. They left scope for recognition of even smaller regions on the basis of multiple factors involving landforms, soils, vegetation, rainfall and also cultural factors like agricultural practices.

In another major study Singh (1977: 34–44) also used both physical and cultural features and put forward a slightly different scheme of regionalization. He added a fourth unit to the three macro-zones, viz. the coasted tracts and islands. Within these four principal zones, he recognized 28 meso-level regions, which were again divided into 67 first-order regions. The later were further divided into 192 second-order regions. Singh also left scope for dividing second-order regions into lower regions.

There have also been attempts to divide the country into regions on the basis of single geographical or cultural features. Using annual rainfall regime as the parameter, five major zones have been recognized, viz. arid, dry semi-arid, wet semiarid, dry sub-humid and humid zones. Making use of vegetation as the criterion which is of course closely related to rainfall, desert, scrub jungle, dry deciduous, moist deciduous and tropical rainforest types have been recognized.

Among archaeologists in India, B. Subbarao was one worker who, true to his background knowledge about the use of geographical approach in historical studies, made an elaborate attempt to correlate the spatio-temporal dimensions of the country's archaeological record with its geographical features. More than half a century ago, he divided the country into three major zones on the basis of their relative importance, viz. nuclear areas, areas of isolation and areas of relative isolation (Subbarao 1958: 8-35). With some modifications, this tripartite division based on historical and archaeological considerations is still useful. More importantly, Subbarao already anticipated the main argument of the present study when he stated that "The divergence in the country is due to the difference in the cultural milieu of the first large scale agricultural communities, in the different regions" (Subbarao 1958: 12).

Considering that crop agriculture and animal keeping, in varying proportions, constitute the defining or principal characteristics of the early farming cultures, the regions recognized by agricultural scientists and specialists in animal husbandry would be of more direct relevance from our point of view. Spate and Learmonth (1957: 7) noted that the rhythm of the monsoon year, expressed in diverse modalities and degrees, is one great common factor of the way of life in India. Using variability in rainfall and soil types as criteria, agricultural scientists made several attempts to define agro-climatic zones (for details see Venkateswarlu 2004: 29-54). In the 1960s, slightly modifying the zonation announced by NARP (National Agricultural Research Project), the Central Arid Zone Research Institute (Jodhpur) announced the recognition of 62 homogeneous agro-climatic zones, each zone characterized by one or more of four major cropping patterns (no cropping, single cropping, intercropping and double cropping). These zones cut across boundaries defining states. In the eighties, the Planning Commission proposed the existence of 15 agro-climatic zones which were later divided into 67 into sub-zones. Subsequently, the National Bureau of Soil Survey and Land Use Planning, working under the sponsorship of the Indian Council of Agricultural Research, recognized 21 agro-ecological regions, which were divided into 60 sub-zones.

Coming to animal husbandry, the picture is once again diverse with cattle, sheep/goat, swine and camel as the principal animals. While keeping of camels and swine is respectively confined to extreme western and eastern parts of the country, cattle and sheep/goats are commonly found in other parts. Among the cattle as many as 30 regional breeds have been recognized and likewise 10 breeds are known among the buffaloes (Nivsarkar *et al.* 2000: 1-5). In sheep and goats as many as 40 and 20 regional breeds have been recognized, respectively. Eighteen breeds are known among poultry and four among camels.

The purpose of making above references to the work of geographers and agricultural scientists is not to propose a one-to-one correlation between the geographical or agro-climatic zones and the spatial distribution of early farming cultures but only to suggest that a meaningful understanding of these early cultures has to take cognizance of the human land-use studies made by other workers. While a detailed use of these studies must await a more systematic understanding of the archaeological record of early agro-pastoral cultures, these already serve as an eye-opener to archaeologists and illustrate how intimately the present-day peasant cultures of the country are tuned to landscape or habitat diversity, reflecting differences in rainfall, length of growing season, landforms, soils and vegetation cover.

Application of Settlement System Perspective

It is in this context that the adoption of settlement system perspective assumes a large measure of importance in protohistoric studies. The core features of settlement system perspective were developed by Lewis and Sally Binford in the sixties of the last century in connection with hunter-gatherer studies. Departing from the traditional interpretations of differences in stone tool assemblages in terms of distinct cultural traditions, they had put forward the famous functional argument which sought to explain such differences with reference to the variations in the actual tasks performed by the artefacts (Binford and Binford 1966; 1979; see also Binford 1972: 135-62). They thus postulated that hunter-gatherer societies may be expected to produce two main kinds of archaeological sites, viz. camp sites and extraction sites (kill sites, quarries, etc.). They defined the settlement system as the way such specialized locations are related to one another and further pointed out that this concept or perspective offers a "framework that seems most appropriate for interpreting prehistoric stone-tool assemblages (1978: 92-3). Based upon his prolonged ethnoarchaeological research among the Nunamiut Eskimos and comparing their life strategies with those of tropical hunter-gatherer societies, Binford formulated the well-known forager versus collector model of hunter-gatherer settlement systems (Binford 1980). His more recent book *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building* offers many helpful guidelines for archaeological use of the settlement system model (Binford 2001).

To be fair to other workers, already in the 1940s Gordon Willey carried out a regional survey of archaeological sites of higher cultural stages in the Viru Valley of Peru and recognized differences among them in terms of both locations and functions (Willey 1953). This work served as the beginning of settlement pattern studies, which in subsequent decades picked up under the direct or indirect influence of New Archaeology. A considerable body of literature exists now on settlement pattern studies (Chang 1968; Rouse 1972; Trigger 1978: 167-93). But it is necessary to distinguish between the two concepts of settlement pattern and settlement system. Settlement pattern refers only to the number, nature, size and distribution of sites on a given patch of landscape. Settlement system is larger in scope and is concerned with the investigation of various classes of sites within a given region and their articulation with the physical and biological as well as social components of its environment in order to ensure the survival of the group.

Two fundamental assumptions underlie the concept of settlement system. First, man is part of an ecosystem. Secondly, human cultures are systems of functionally interrelated elements; they are adaptive mechanisms and their articulation with the biophysical and social environments gives rise to a series of patterned relationships. A settlement system is peculiar to a given social group and the regional environment it occupies and exploits. Although neighbouring groups may share similar genetic, linguistic and historical traditions, they will have their own settlement systems on account of differences in both natural and social environments.

In the case of subsistence level societies the relationships between culture and its environment are best reflected in the technological-economic adaptations and cultural forms arising from these adaptations. These together constitute the settlement system. The factors governing the operation of settlement systems are many and varied, and differ to some extent from hunter-gatherer to settled, agro-pastoral societies. In general resource use schedule governs both settlement location and demographic arrangement.

Similar frameworks need to be developed for the study of early farming cultures of India. It is here archaeologists need to take the help of geographers, climatologists, ecologists and agricultural scientists including experts in animal husbandry. As pointed out by Spate and Learmonth, monsoonal climate is obviously the most important common factor; and the amount of rainfall and its seasonal nature largely govern the length of growing season. The form of landscape, the nature and depth of soil cover, the nature and availability of pasture lands, the presence of perennial surface water bodies in the form of rainwater pools, tanks, stream flows and spring flows, and the availability of various clays, rocks and other materials are the other factors that need to be taken into account.

The introduction of irrigation facilities, improvements in agricultural techniques, increasing use of chemical fertilizers and development of new breeds of animals and plants have now created a situation of anything can be grown anywhere, thereby leading to the obliteration of traditional regional boundaries of various food crops and domestic animals. Therefore it is difficult to attempt an exact zonal correlation between the boundaries of early agro-pastoral complexes and those of the peasant cultures of the ethnographic present. But this does not permit us to abdicate the responsibility of proposing such correlations or general patterns. For instance, it has already been pointed out above that at least three major agricultural zones exist in the country, viz. the millet-growing zone of western and southern parts, the wheat and barley dominated areas in northern India (Punjab and Haryana) and the rice-growing tracts of eastern and northeast India. These zonations clearly correspond to climatic factors, particularly rainfall which tends to increase as one proceeds from west to east. Some finer divisions can be visualized within these broad zones. For example, in the Ganga plains wheat and barely dominate in the western part up to the Doab, while paddy cultivation picks up in importance as one moves eastwards; and in northeast India rice is for all practical purposes the sole crop. Within these regions, sub-regional differences exist in crops. In the Siwalik zone of Jammu four or five agroclimatic zones have been recognized. In Maharashtra paddy is the only crop in the high rainfall belt of Konkan coast, while *jowar* and *bajra* are common in the plateau or *desh* region. In Karnataka, *jowar* and *bajra* are common in northern Maidan, while *ragi* takes their place in southern maidan zone. This broad zonal pattern in agricultural crops is complemented by the existence of regional breeds among domestic cattle, buffaloes, sheep and goats. Cattle breeds like Hallikar, Khillari, Ongole and Kankrej and buffalo breeds like Mehsana and Murrah are well known.

In the absence of detailed studies, at present only broad correlations can be suggested between the archaeological cultures and contemporary peasant ways of life. As attested by the evidence from Mehrgarh, Burzahom and other sites, wheat and barley were the dominant crops in northern/northwestern India and the central zone of Indo-Gangetic plain, while sites like Lahuradeva, Taradih and Sonepur, Mahisdal and Golbai Sasan lying in the region covered by eastern U.P., Bihar, Orissa and West Bengal show widespread evidence of paddy cultivation. There are indications of regional differences in the western part of the country. While the Deccan Chalcolithic sites and protohistoric sites in Gujarat have good evidence of *jowar* and *bajra* and also wheat and barley, the South Indian Neolithic sites are dominated by cultivation of local millets and *ragi*.

An interesting picture seems to emerge when we juxtapose the spatial spreads of these early agropastoral cultures with fifteen agroclimatic zones identified by the Planning Commission (Basu and Guha 1996: chapters 1 to 3, esp. pages 38, 75-80; 85-115). Among these, zones 1 (western Himalayas) and 15 (Islands) may be left out of consideration. Zones 3 and 4 (Lower and Middle Gangetic plains, respectively), zones 2 (Eastern Himalayas) and 7 (Eastern Plateau and hills) are dominated by paddy cultivation. These correlate with the Neolithic-Chalcolithic cultures of eastern U.P., northeast India, Bengal delta, and Bihar and Orissa. Zone 6 (Trans-Gangetic plains), comprising Punjab, Harayana, Delhi and Ganganagar district of Rajasthan, is known for its wheat production, while paddy, *jowar*, etc. play but a minor role. This zone corresponds to the area of concentration of Harappan and Late Harappan cultures, which are based on wheat cultivation. In zone 5 (comprising western part of U.P. and Uttarakhand) both wheat and millets (*jowar* and *bajra*) are cultivated and this area forms as it were very a transitional zone between the wheat-growing area to the west and the rice-growing area of eastern and northeastern India. Agro-climatic zones 8, 9, 10 and 13, covering large tracts in the western half of the country (Karnataka, Maharashtra, Gujarat and Madhya Pradesh), constitute precisely the area which has preserved a rich archaeological record of various Neolithic-Chalcolithic cultures. These include the Banas, Kayatha, Malwa, Jorwe and the Southern Neolithic cultures. These cultures have yielded grain remains of millets like *jowar, bajra* and *ragi*.

What has been suggested above is only a tentative and coarse-grained correlation. A detailed attempt is required on this topic and this entails a closer understanding of the various features of the agro-climatic zones as well as a comprehensive study of the archaeological record including the biological remains of the various Neolithic-Chalcolithic cultures investigated in different parts of the country. Closer metrical analyses of the faunal material from archaeological sites might also bring out regional difference in the breeds of cattle and sheep/goats, which played an important role in the life of these early agricultural communities.

It is my firm belief that a detailed re-examination of the archaeological record of these cultures from a settlement system perspective will reveal interesting organizational diversity at both regional and sub-regional levels. The signatures of this organizational diversity could be expected to occur, among other domains, in the following aspects:

1. Differences in settlement pattern or locational setting of sites.
2. Relative roles played by plant cultivation and animal keeping.
3. Relative importance of hunting and foraging activities.
4. Nature and degree of contacts with neighbouring hunter-gatherer and/or other agro-pastoral groups.
5. Differences in material culture equipment.
6. Differences in sociological/ideational spheres, as reflected in intra-site patterning of structures, burial practices, use of ceramics, rock art, etc.

Organizational Diversity within the Southern Neolithic Culture

Based upon my familiarity with the actual sites and materials belonging to the Southern Neolithic culture, I would like to make some additional observations about the organizational aspects of this culture. The Southern Neolithic culture has a very long history of investigations stretching back to the discoveries of Robert Bruce Foote in the 70s and 80s of the 19th century; ashmound studies go back, to the beginning of the century. It covers the present-day states of Karnataka and Andhra Pradesh and a large portion of northern Tamil Nadu, and occupies geographical space nearly equivalent in extent to that of the Indus civilization. In temporal terms too, the large number of C-14 dates allows us to say that it matches the Indus civilization and covers practically the whole of second and third millennia B.C. Moreover, the large number of small and large excavations and regional surveys undertaken in the area during the last six decades have given us a fairly comprehensive picture of the material and non-material aspects of this culture.

The Allchins recognised three broad phases in the development of this culture as follows (Allchin and Allchin 1968: 161-66):

Phase I: Dated between 2300 B.C. and 1800 B.C.; characterized by ashmounds and hill settlements; well-developed lithic tool traditions; and handmade coarse grey or buff brown pottery; a small amount of red pottery with purple paintings.

Phase II: Dated between 1800 and 1500 B.C.; appearance of perforated, spouted and rusticated varieties of pottery; also appearance of a small number of copper artefacts; appearance of settlements in open plains or along river banks.

Phase III: Dated between 1500 and 1000 B.C.; increase in copper/bronze artefacts; contact with the Deccan Chalcolithic culture, as reflected in the appearance of wheel-made black-on-red pottery reminiscent of Jorwe ware.

More recently Fuller (2002: 194) and Asouti and Fuller (2010: 41) have put forward a somewhat different three-phase division (I to III) of the Southern Neolithic and, based upon the availability of calibrated dates, take back the antiquity of the culture to the beginning of the third millennium B.C. They date the three phases between 2800-2200 B.C., 2200-1800 B.C. and 1800-1000 B.C., respectively. While broadening of the time range is justified and welcome, their proposal about internal partitioning of the culture is narrow in scope. The division proposed by the Allchins is preferred here, as it is based on the assessment of almost all important aspects of the culture.

Of direct relevance to the theme of this paper is the view I put forward in 1973 regarding the existence of zonal variants within this Neolithic culture (Paddayya 1973: 87-91). According to this view, the present Bellary and Raichur districts and the adjoining Shorapur Doab, located in the Krishna and Tungabhadra valleys, served as the nuclear zone. Many of the well-known sites like Piklihal, Utnur, Kodekal, Budihal, Watgal, Tekkalakota and Sanganakallu are located in this zone; all belong to Phase I of the culture. While the culture continued to flourish in the nuclear zone, it began to spread into the outlying regions in the second phase. Five of these later variants were identified. Variant 1, dated to the third phase of the culture, is spread along the Bhima river immediately upstream of the Shorapur Doab. This is the border area between Karnataka and Maharashtra and preserves clear evidence of the influence of the Deccan Chalcolithic culture. Variant 2 covers Belgaum district in the Upper Krishna basin (Sundara 1971a). Variant 3 is spread over the upper reaches of the Kaveri and Tungabhadra rivers, including some portions of the Malnad zone (Nagaraja Rao 1964, 1984; Sundara 1971b). Tentatively, sites found in Mandya, Tumkur and Kolar districts of Karnataka and North Arcot district of Tamil Nadu were also originally included in this variant (Seshadri 1964; Narasimhaiah 1980). As will be pointed out later, some of these sites now constitute a separate variant. Variant 4 covers the upper reaches of the Pennar River in Anantapur district of Andhra Pradesh (Rami Reddy 1976). Variant 5 is located in the adjacent Kurnool district (Karthikeya Sarma 1967; *IAR* 1967-68: 3-5).

Since this view proposing five variants was put forward in 1973, much additional field research has been undertaken in different parts of South India. It includes regional surveys, as in the case of eastern and western coasts and Cuddapah region area of Andhra Pradesh. Also excavations have been undertaken at several sites such as Banahalli, Budihal, Sanganakallu and Watgal in Karnataka; Hulikallu, Ramapuram and Veerapuram in Anantapur and Kurnool districts, Polakonda and other sites in the Telangana region of Andhra Pradesh; and Mayiladumparai (Rajan *et al.* 2004) in Tamil Nadu. These fresh studies call for some clarifications about the sub-regional diversity already recognized within the Southern Neolithic culture. It is also possible to identify some additional sub-regional variants.

Let us first consider the work in the nuclear area itself. The two seasons of excavation (1991-92 and 1992-93) at the site of Watgal confirmed the status of Bellary-Raichur area as the nuclear zone and also the continuity of Neolithic occupation into phases II and III and its transformation into the succeeding Iron Age (Shaffer 1992; Devaraj *et al.* 1995). The Neolithic deposit at this site is divided into four occupations (I to IV), with the earliest dated between

2700 and 2300 B.C. by means of calibrated C-14 dates. During my brief visit to the site in 1995 I noticed layers of ash in the abandoned trenches, thereby suggesting that an ashmound was associated with the site. A noteworthy cultural feature is the occurrence of carbonized remains of betel nut (*Areca catechu*) representing the earliest use of this plant in South Asia. Interestingly, the Neolithic occupation at this site was preceded by a cultural stage marked by flake artefacts of quartz, chert and dolerite, similar to those found earlier in the ashmound excavations at Sanganakallu and Palavoy. Additional work on this cultural stage is urgently called for, as it may hold clues for the emergence of food-producing way of life in this part of the country.

Some observations are also called for about my own field studies concerning ashmound sites of southern Deccan. Struck by the occurrence of Neolithic habitation debris around all major ashmounds in the nuclear area and closeness of these sites to surface water sources and grazing lands, I concluded that these sites were not mere cattle-penning stations but were regular pastoral camp sites where both cattle-penning and human occupation took place (Paddayya 1993). The six seasons of excavation at Budihal (1989-90 to 1995-96) corroborated this inference by exposing several functionally differentiated areas at the site: cattle-penning area; cow-dung dumping and burning area; human occupation area including human burials; an animal butchering platform; chert workshop area; and grinding grooves for preparing polished stone artefacts (Paddayya 2002). They are several uncalibrated ^{14}C dates which securely place the Budihal site between 1900 B.C. and 1400 B.C. The calibrated dates stretch the lower limit of occupation to 2400 B.C. The lowermost levels of this site still remain undated and may stretch the antiquity of the site to a still earlier date. The nearby ashmound site of Kodekal has a calibrated ^{14}C date of 2465 $\pm$ 108 B.C. (for this and other calibrated dates for the Southern Neolithic sites, see Possehl 1988).

One important feature that strikes us about the Shorapur Doab concerns geographical diversity within it. The Kodekal-Kakkera hill range, running close to the north bank of the Krishna, is a typical granitic country with poor sandy soils but contains rich pasture lands. It is in this tract that all major ashmounds such as Budihal, Kodekal, Kamnatgi and Kakkera are located. As against this hilly landscape, the adjacent Shahpur plains on the east and Hunsgi-Baichbal valleys on the west are plainland tracts with a thick cover of black soil supporting rich rainfed agriculture. These tracts also have ashmounds but of much smaller dimensions, implying pronounced emphasis on crop raising. At present-day weekly markets held in big villages like Kodekal and Hunsgi one notices transactions in items like food grains brought from the valleys and Shahpur plains and forest products (plant and animal) brought from the hill-tracts. It is most likely that such specialized uses of the resources of smaller areas within sub-zones had already come up in Neolithic times. In the Raichur Doab which adjoins the Shorapur Doab on its southern side, there is the interesting contrast between the Lingsugur and Deodurg ranges of granite hills close to the Krishna (containing big ashmound sites like Gaudur, Eachanal and Wandalli) and the Maski plains further south with a good soil cover containing occupation sites like Maski itself.

Another major piece of field research in the nuclear area concerns the Sanganakallu-Kupgal project carried out between 2002 and 2004 (Boivin *et al.* 2005). This project involved the mapping of all archaeological features (stone working centres, water sources, rock art spots, ashmounds and habitation spots) found on the granite hills between Kupgal and Sanganakallu villages in Bellary district. Their re-excavation on the Sannarachamma hill at Sanganakallu led to the identification of ash deposits within the Neolithic settlement, dated between 1950 B.C. and 1740 B.C. (calibrated). An important finding arising from their archaeobotanical studies is that the basic crop-package of the South Indian Neolithic consisted of four items, viz. browntop millet (*Brachiara ramosa*), bristly foxtail (*Setaria verticillata*), mung bean (*vigna radiata*) and horsegram (*Macrotyloma uniflorum*). Another noteworthy finding of the project concerns the preponderance of sheep/goat bones, which implies that caprine pastoralism picked up in importance during the middle phase of the Southern Neolithic.

The nuclear zone has preserved extensive evidence of rock art from Piklihal, Kupgal and many other sites (Allchin and Allchin 1996). Another noteworthy feature is that all dated ashmounds in the nuclear area and elsewhere belong to the early and middle phases of the culture. Ashmounds seem to diminish in importance, if not altogether disappear, in the final phase. This may be related to a spurt in sheep/goat pastoralism as well as increased emphasis on crop agriculture which requires the use of animal dung for soil-manuring purposes. In this connection it is also interesting to note the use of vitrified ash blocks quarried from ashmounds for preparing circles around some of the megalithic monuments in the Shorapur Doab dated to the early part of the Iron Age (Mahadevan 2008).

Variants 1 and 2 occupy plainland tracts along rivers. Variant 1 comprises a group of 80 small- and medium-size sites found along the Bhima River just upstream of the Shorapur Doab. These sites are found in Sindgi and Indi taluks of Bijapur district and belong to the third phase (c. 1200-800 B.C.), as proved by the common occurrence of Jorwe ware of northern Deccan Chalcolithic origin. Ashmonds do occur at a few places but are no longer prominent markers on the landscape. This may mean that plant agriculture and sheep/goat pastoralism were emerging as dominant components of economy. Variant 2 is made up of a group of 30 sites found in Belgaum district forming part of the Upper Krishna basin. These sites belong to the middle phase of the culture and ashmounds are still an important feature. Lacking fresh field investigations no additional observations are warranted about these two variants.

Variant 3 covers the Malnad and semi-Malnad zones of Karnataka (for general geography of Karnataka, see Learmonth 1961). It was originally meant to cover the districts of Dharwar, Shimoga, Chikmaglur, Hassan, Mandya and Mysore. As we will soon note, the southern part of area occupied by this variant will now form part of a separate variant. This area is drained by various small streams forming part of the upper reaches of the rivers Tungabhadra and Kaveri. The semi-Malnad tract (called *Garinadu* in Kannada) is a transitional zone between the true Malnad and Maidan zones and varies from 15 to 60 km. in breadth. It is a hilly, dissected country with altitudes ranging from 670 m. in the north to 1000 to 1300 m. in the south. Annual rainfall reaches up to 90 cm. This is rainfall region VI of Learmonth and Bhat (1961: Fig. 7, p.33). Rice is the main crop, followed by *ragi* and *jowar*.

Two well-known concentrations of sites were found earlier in this area – one discovered by Nagaraja Rao in the upper reaches of the Tungabhadra in Dharwar district (e.g. Hallur) and the second in the upper reaches of the Kaveri covering Mandya and Mysore districts (e.g. T. Narasipur and Hemmige). Subsequently a good number of additional sites have been reported by Sundara and other workers in the upper reaches of the Varada, Tunga and Bhadra rivers covering Shimoga and Chikmagalur districts. Some of these sites have preserved habitation debris and yielded polished stone tools, ceramics and other antiquities (for details, see Patil 2007). Unfortunately, so far no site has been excavated among these nor are any dates available. The available dates from Hallur show that these sites belong to the terminal phase. Besides millets and pulses, rice was in use at Hallur (Kajale 1991: 160). In this connection we may note the proposition made by Fuller that the basic crop-package of the Southern Neolithic consisted of two millets (browntop millet and bristly foxtail) and two pulses (mung bean and horse gram) and that these are indigenous to the region (Asouti and Fuller 2010: 39). The semi-Malnad zone may have witnessed localized attempts at domesticating these food crops.

Variant 4, with its locus in Anantapur district of Andhra Pradesh, covers the upper reaches of the Pennar basin and is occupied by granite formations of the Archaean age. Geographically, this area is an extension of the nuclear zone but without evidence of the early phase of the Neolithic. The middle and late phases are represented by both ashmounds and habitation sites. It has given good evidence of rock art, as in case of the nuclear zone (Rami Reddy 1971).

Variant 5, centered in the neighbouring Kurnool district, deserves some additional remarks. Excavations were conducted at Veerapuram (Sastri *et al.* 1984) and Ramapuram (*IAR* 1980-81: 3-7; 1981-82: 3-7; 1982-83: 3-5) and also the excavations in Billasurgam caves have given some useful clues about cultural interactions. No less important, Venkatasubbaiah's detailed surveys leading to the discovery of 50 sites in the neighbouring Cuddapah district and trial excavations at Hanumantharaopet and two other sites in this area, call for enlargement of the spatial extent of this variant (Venkatasubbaiah 2007). It now covers the middle reaches of the Pennar River and its various tributaries. The area consists of tableland strips and ridges of limestones, shales and quartzites belonging to the Cuddapah and Kurnool formations. It receives an annual rainfall of about 60 cm. One important aspect concerns the location of settlements away from hills and hillsides; they now tend to concentrate on plains covered with good soil cover, close to or away from river banks. Isolated occurrences of clusters of polished stone axes away from settlements have been interpreted as spots of forest clearance and *zhum* cultivation (Murty 1989: 68). Ramapuram excavation and the Cuddapah group of sites have given evidence of cultivation of crops like barley, foxtail millet, finger millet, horsegram and hyacinth bean, all grown as rain-fed crops but probably benefiting from gravity flow irrigation. Besides cattle, sheep/goat pastoralism became a prominent feature. This variant has also preserved interesting evidence of interaction between the agropastoral groups and hunter-gatherer societies occupying the hilly and forest tracts of the some region (Murty 1989: 69). The Mesolithic levels from the Billasurgam caves produced Neolithic pottery and some copper artefacts. It has been inferred that these were procured from the local Neolithic groups in exchange for forest products including meat from hunted animals.

Besides the five above-mentioned variants, field studies in South India during the last quarter-century have given good indications of the existence of four other regional variants – one each located in northern Tamil Nadu and coastal Karnataka and the other two based in Andhra Pradesh (one in south coastal tract and the second one in Telangana). A common feature of all these variants is the absence of ashmounds. This might suggest increasing importance given to crop husbandry and sheep/goat pastoralism.

The coastal Andhra Pradesh variant (variant 6) lies immediately to the east of variant 5 described above. It covers the districts of Guntur and Prakasam. The area is partly covered by the lower Krishna valley and partly drained by the Gundalakamma and other smaller streams emptying directly into the Bay of Bengal. It is a plainland but dotted here and there with hills and ridges forming part of the Eastern Ghats. There is a thick black soil cover which is well suited for agricultural activities. The annual rainfall varies from 60 to 100 cm. This part of coastal Andhra Pradesh has a number of Buddhist sites belonging to the early historical period, including Amaravati and Nagarjunkonda. In addition to the three excavated sites of Nagarjunakonda, Kesarapalli and Elchuru, David Raju (1990) explored over 40 sites in the area, yielding ceramics and stone artefacts. The faunal remains from Nagarjunakonda and Elchuru (Thimma Reddy *et al.* 1990) show evidence of cattle and sheep/goat pastoralism and wild game hunting. Unfortunately, no evidence of plant remains is available but, considering that this is presently one of the rich areas from agricultural point of view, it is most likely that the Neolithic groups cultivated both millet and pulse crops on an extensive scale.

Variant 7 covers the Telangana region sandwiched between the middle reaches of the Godavari and Krishna rivers Subbarao (1958: 20-21) made a pointed reference to the distinctive nature of geographical features as well as present-day peasant way of life of this region, and contrasted these with those of the adjacent Maharashtra plateau on the western side. Unfortunately, till now no regular regional survey of protohistoric sites has been undertaken in this part of Andhra Pradesh. It is a semi-arid tract (with altitude varying from 435 m to 670 m and rainfall from 60 cm to 100 cm) occupied by Archaean formations which are traversed in the northern part by sedimentary rocks belonging to the Purana formations. While the hills and hill-ridges have good pasture reserves, the valleys or basins formed between them have a good soil cover suitable for agricultural operations. So the area could have supported prosperous settled village farming communities. That this indeed was the case is proved by less than a dozen Neolithic sites found in different parts of Telangana (Krishna Sastry 1983: 19-50). Thogarrai, Kadambapur, Peddabankur and Budigapalli in Karimnagar district, and Polakonda, Kolakonda and Devaruppala in Warangal district are some of these important sites. These have preserved occupation deposits and are located on smaller streams joining the Krishna or the Godavari. These are situated in the foothills zones of granitic hills or close them. Some of these sites like Polakonda have yielded evidence of dwelling structures, ceramics and stone tool assemblages of both polished axe and stone flake traditions. No dates are available for these but it is presumed that these belong to the second and third phases of the culture. Millet and pulse crops and cattle and sheep/goat pastoralism were dominant elements of this variant.

Variant 8 occupies the area immediately to the south of Anantapur district housing Variant 4 described above. In fact, even from a geographical point of view it is a continuation of hilly landscape occupied by Archaean granite-gneiss formations. This area, covering the districts of Kolar in Karnataka and North Arcot and Dharmapuri in Tamil Nadu, forms the upper reaches of the Palar and Ponnaiyar rivers which drain into the Bay of Bengal. There is a tendency for the sites to occur close to or in the foot-hill zone of granitic hills. Following upon the excavations at Paiyampalli in North Arcot in the 1960s which produced evidence of Neolithic occupation from a hill terrace (ceramics, polished stone tools, flakes of jasper, and rammed floor with post-holes) (*IAR* 1964-65), Narasimhaiah (1980) discovered a group of five habitation sites in the Krishnagiri and Harur taluks of the neighbouring Dharmapuri district. More recently, Rajan *et al.* (2004) excavated a hillside site at Mayiladumparai with 1.4 m thick habitation deposit. From the rich faunal record it would appear that animal husbandry was a dominant feature of economy.

To this complex also belongs the site of Banahalli in Kolar district (*IAR* 1983-84: 42-46). It is also a hillside site located in the upper part of the Palar basin. Excavation exposed a four-period culture-sequence. Periods I and II respectively represent Neolithic and Neolithic-Megalithic transition stages. The Neolithic levels produced a good quantity of ceramics, many house floors and remains of an open-air pottery kiln. There are full indications that regular regional surveys will lead to the recognition of a large number of additional sites in this area.

The west coast of the Indian peninsula has provided evidence of yet another variant (Variant 9) of the Southern Neolithic culture (Patil 2008). The evidence comes from the Canara coast bordering the Arabian Sea. This is a narrow, north-south running tract covering the three districts of Uttara Kannada, Udupi and Dakshina Kannada. It is a zone of high rainfall which varies from 250 cm to 450 cm. Sandwiched between the actual coastal strip featuring sand dunes and mudflats on one side and the mountainous Western Ghats on the other lies the tract of low hills and spurs of the Ghats. Many small streams rise in the Ghats proper and cut through this low, hilly tract and join the Arabian Sea after completing short courses. This hilly tract is clothed in good vegetation cover and also supports rich wild life.

Over the last 40 years stray occurrences of polished stone tools have been reported from about a dozen spots in Uttara Kannada and Udipi districts. These are well-shaped specimens (axes, rubberstones and grinding slabs and also a crescent-shaped implement which has been called a hoe). At two places – Anshi in Uttara Kannada district and Kurkalu in Udipi district – these implements are associated with habitation deposit, which has also preserved a floor-like feature of laterite rubble and grey and buff pottery typical of the Southern Neolithic. It seems likely that these archaeological remains belong to small groups from the Malnad zone which colonized the coastal tract in the third phase of the Neolithic culture. Considering that shifting cultivation (locally called *Kumri*) is still practised by some of the local groups, it is very probable that rain-fed agriculture comprising rice and other crops was practised by these coastal groups. In addition they would also have made use of aquatic resources and wild life of the hilly tracts.

Anthropologists B.G. Halbar and G. Sarana have recently published an interesting monograph entitled *Cultural Traits and Cultural Zones in Karnataka* (Halbar and Sarana 2009), which lends support to our proposition recognizing subregional or zonal variants within the Southern Neolithic culture. This study is based on detailed field investigation of ecological, social and ideological aspects of communities living in 49 villages spread over the districts of Bijapur, Belgaum and Dharwar in the Maidan country and the coastal district of Uttara Kannada. While not ruling out variability even at the intra-district level, Halbar and Sarana recognize important differences between the coastal village way of life and that of the Maidan zone, which to a large extent arise from ecological differences. One may consider, for instance, the contrast between the nucleated villages of the Maidan zone and the highly scattered hamlets of the Kanara region; the flat versus sloping roofs of temples and dwellings; the traditional nature of agricultural implements and domestic utensils of the Kanara region as compared to those used in the Maidan zone; reliance on paddy cultivation as against the use of millets in the plateau tract; and even differences in footwear and use of saree – *Getagi* and *Kattari* types of saree-wearing in vogue in Kanara region being more akin to the practices of Konkan region in Maharashtra.

These observations about sub-regional variability within the Southern Neolithic culture inspire one to make a few remarks about northern Deccan, which is another important area in the geography of peninsular India and also intensively investigated from the point of view of the study of early agricultural communities (for a review of geographical features, see Joshi and Arunachalam 1962; Deshpande 1948, 1971; Dikshit 1986). Field studies conducted here since the 1950s have revealed a concentration of Chalcolithic sites in the upper reaches of the Bhima and Godavari basins, and in the central zone of the Tapi basin in northern Maharashtra. These sites cover the Savalda, Late Harappan, Malwa and Jorwe cultural phases, spanning from about the beginning of the second millennium B.C. to about 700 B.C. (Dhavalikar 1988). The work in the Godavari and Bhima basins is mostly dominated by large-scale excavations like the ones at Daimabad and Inamgaon.

It is most likely that intensive site surveys in these two basins as well as in the *maval* or foothill zone of the Sahyadris with a higher rainfall (corresponding to the *Garinadu* zone in Karnataka) will bring to light additional sites. There are also indications that the reaches of these two rivers immediately downstream will yield new sites (e.g. Panja 1996). One may expect these new sites to reveal interesting zonal differences in the functioning of Chalcolithic settlement systems of the region. That such differences in fact exist is shown by Shinde's intensive field studies in Dhule and Nandurbar districts (Khandesh area) lying in the middle reaches of the Tapi basin (Shinde 1998). He has identified over one hundred sites belonging to the Savalda, Late Harappan, Malwa and Jorwe phases. Interestingly, the Savalda and Late Harappan sites are found in a linear fashion along the main Tapi River, whereas the Jorwe sites tend to occur along the tributary streams; their occupants appear to have concentrated on sheep/goat pastoralism and also exploited the pastures of hilly tracts constituting the upper reaches of tributary steams. It will be interesting to visualize the changes that may have been brought about in the realm of material culture due to the occupation of these different landscape settings. One may also consider extending field studies further east into the Vidarbha region which falls within high rainfall zone with moist deciduous vegetation and supports paddy cultivation.

The above comments about zonal diversity in the Southern Neolithic culture and Chalcolithic phase of northern Deccan also hold good in the case of protohistoric phase of the Ganga Valley. The seemingly tennis court-like monotony of the landscape actually conceals extremely interesting micro-regional differences of slope and aspect, characterized by *bhangar* or *khadar* soils, doabs, *bhabars* (gravelly piedmont patches), *bhurs* (sandy soil patches), *jhils* (lakes) and *chaurs* (marshy lands) (Spate and Learmonth 1967: 534-570). Add to these, variability in rainfall from west to east – all leading to significant differences in crops and material culture items of the present-day peasant way of life. It is possible to trace their genesis to the protohistoric past of the region.

It will not be out of place here to point out that in recent years interesting correlations have been put forward between early agricultural communities and language dispersal (e.g. various essays in Bellwood and Renfrew 2002). Raising objections to the earlier views about the Elamite affiliations of Dravidian languages, Fuller (2002; see also Southworth 2005: 229-287) has argued that Proto-Dravidians in the form of seed-using forager groups were already in existence in peninsular India prior to beginnings of agriculture and that the regional groups within the Dravidian family of languages could be traced back to the Neolithic-Chalcolithic stage. Southworth (2005: 324-334) has correlated the Neolithic-Chalcolithic cultures of central and northern India with the Munda and Indo-Aryan language families. There is much scope to pursue further this topic of linguistic archaeology.

Role of Ideational Perspectives

The above statements arguing for the need to unravel organizational diversity among the early agro-pastoral cultures by employing settlement system perspective should by no means be construed to mean that we will automatically have a full-scale understanding of their character. Nothing can be farther from truth. On the contrary, there are many aspects which concern the minds of these early settled groups that need to be probed by adopting approaches other than those dealing with human adaptations. It is here the ideational approaches forming part of post-processual archaeology come into the picture. It needs to be clarified that these soft or mind-oriented approaches and adaptation-oriented settlement system perspective are not mutually contradictory but complementary.

The main issue that needs to be highlighted here is that peasants in every part of India treat the landscape on which they carry out their daily activities as both enabling and ennobling. The landscape is viewed by people not merely as physical compass which provides various resources and enables them to satisfy their material needs but simultaneously its features, animate and inanimate, enter into their consciousness and ennoble their minds. The people culturally inscribe the landscape they occupy. This is, for instance, reflected in the sanctification of hills, caves and rock shelters and perennial water sources like springs, and worship of animals, plants and agricultural implements. It is commonplace that village folk on their daily rounds to farmlands or pasture grounds stop for a few moments to pay silent obeisance to a deity enshrined on a nearly hillock or to a time-hallowed banyan or *shammi* tree serving as a nodal point for periodic religious congregations. Over and above worship of domestic animals on festive occasions, it is also not uncommon that the carcasses of prized bullocks or cows, instead of being handed over to the village butcher, are ceremonially buried by their owners on the farmlands. It is being asserted here that this meaning-impregnated character of the landscape and adoption of soft attitudes to animals and plants had their origins in the early agro-pastoral cultures. Post-processual trends provide us helpful strategies for investigating this aspect.

Starting off with his work on the meaning-impregnated character of the material culture of the East African pastoralists (Hodder 1982), Hodder published his book *The Domestication of Europe* in 1990 in which he sought to interpret the entire Neolithic culture sequence in Europe as the playing out of a long-term structure involving an opposition between the *domus* (house and domestic world) and the *agrios* (wild) and consisting of a set of rules or codes gradually spreading across Europe. Julian Thomas adopted a symbolic or hermeneutical approach to the British Neolithic archaeological record (structures, burials, etc.) and identified a great degree of variability between different areas in terms of social and cultural practices (Thomas 1991; 2001). Noteworthy too is Tilley's (1994) phenomenological approach to the British Neolithic landscape. Mark Edmonds's (1999) book *Ancestral Geographies of the Neolithic* visualizes the Neolithic Britain as a world shaped by kinship, ancestry and other forms of social affiliation. The dead were a powerful presence and distant times and places held a particular fascination for the people. These themes were brought into a sharp focus on the occasion of periodic gatherings at monuments, enclosures and tombs.

There is enough data in the archaeological record of early agro-pastoral cultures of India which warrants the use of these interpretive trends. In fact important observations have already been made about some aspects of the record. The Zhob valley female figurines depicting exaggerated breasts have been interpreted as mother goddess figurines; these formed part of a fertility cult meant for warding off uncertain life-conditions like droughts and floods common in the Baluchistan area (Banerji 1987). The engraved design showing a stag between two hunters (all with exaggerated genitals) and two circles drawn above it (rising and setting sun?), found on a stone slab piece from Burzahom, are viewed as signs of phallicism or fertility cult (Pande 1971). Dhavalikar (2009) has interpreted the motif of human body placed within peacock's belly (peacock symbolizing mother goddess), forming part of paintings found on Cemetery H pottery at Harappa, as a symbolic depiction of the concept of rebirth. The large number of clay figurines of bulls from the site of Kayatha have again been interpreted in a non-functional way (Ansari and Dhavalikar 1975). While the naturalistic ones have been viewed as art objects, the stylized bulls are interpreted as objects meant for promoting fertility cult. The female clay figurines (in some cases found in a clay box) from Inamgaon have been interpreted as mother goddess representations, while the male clay figurines have been treated as proto-Ganesa representations and worshipped on occasions like community cooking and feasting (Sankalia 1977a: 95-98; Dhavalikar 1970).

Comprehendsive and theoretically well-grounded efforts are required along these lines; there are many other aspects of the archaeological record which can inform us about the cognitive, symbolic, aesthetic and other ideational dimensions of these early agricultural societies. The more prominent among these aspects include site locations in relation to prominent landmark features such as water springs, hill-ridges, caves and rock-shelters, sunrise and sunset; human burials, with or without grave furniture; partial or full animal burials; ceramics, stone tools and other items of material culture equipment of non-functional character; terracotta figurines of animals and other representations; ornaments like bangles, beads, rings, etc. of various materials; peculiar shaped stones or other natural objects collected from the vicinity and sacralized; and rock art in the form of bruisings and paintings of animals and humans.

Conclusion

There is perhaps no better way of concluding this paper than by citing the work on the Southern

Neolithic culture as an excellent example of the relevance of both adaptational and ideational (or hard and soft, to put in popular language) approaches for investigating the early agro-pastoral communities. The available data clearly shows that around 5000 years ago these Neolithic groups occupied the Bellary-Raichur zone of Southern Deccan zone studded with granitic hills rising steeply up to 150 to 200 m above ground level and initially preferred to make use of the flat tops, shoulders and feet of these hills for establishing their settlements. The area was probably receiving slightly higher rainfall at the beginning of the Neolithic culture and was covered with dry evergreen *Acacia-Albizia* savannah vegetation, supporting both rich wild life and pasture lands for domestic animals (Asouti and Fuller 2010: 87). It thus provided excellent scope for the Neolithic settlers to specialize in cattle and, to a smaller extent, sheep/goat pastoralism. This was complemented by cultivation of millet and pulse crops and exploitation of wild plant and animal foods. As the culture began to spread in the second and third phases to outlying regions with landscape peculiarities of their own, suitable changes followed, e.g. more reliance on crop agriculture and sheep/goat pastoralism.

As emphasized by workers right from Bruce Foote, the Southern Neolithic is a culture extremely well suited to the Archaean granitic landscape which is dotted with hills, drained by small and big streams, and characterized by semi-arid climate. While continuing in some measure the hunting and foraging traditions prevalent in southern Deccan for many hundred thousand years, the neolithic groups initiated more dynamic land-use patterns involving the preparation of fixed dwellings on or close to hills and streams, manipulation of certain animals and plants and raising them under their control, and development of sophisticated stone technologies. The close fit that was arrived at between the environment and the culture explains its survival for two thousand years. This long duration in turn fostered strong bonds between the people and the natural world, the latter's components eventually getting embedded into their consciousness. There are many signatures in the archaeological record of this embeddedness of nature into human consciousness. One may consider, for example, the various instances of rock art recorded in Raichur, Bellary, Anantapur and other areas. At many places the bruisings and paintings depicting both domestic and wild animals are made on rock surfaces which directly overlook settlements. Another form of representation consists of punctured figures of a bull, a snake, a deer and a peacock on a pottery lid from Tekkalakota (Sankalia 1964: Fig. 1). These representational pictures of animals suggest that the Neolithic groups, while no doubt exploiting the natural world for satisfying their various material needs, simultaneously imbibed its components into their consciousness and adopted an attitude of respect and gratitude.

Boivin has proposed that the locations of ashmounds hold clues about the cosmology of Neolithic communitie (Boivin 2004). She believes that the locational settings of Kudatini and Toranagallu ashmounds in Bellary district were influenced both by environmental factors and by considerations of significant views, inter-site visibility, local solar events and cardinal directions. The excavated ashmound site of Budihal affords another fine example. Located as it is on a sandstone plateau, it provides a commanding view of the surrounding landscape for a distance of 10 to 15 km. and also enables one to marvel at the rising and setting sun.

Allchin made elaborate comments about the symbolic dimension of ashmounds. His monograph *Neolithic Cattle-Keepers of South India* (1963) brought together various strands of both archaeological and ethnographic evidence and showed that the burnings of accumulated cow-dung at the settlements formed part of a Neolithic ash-fire cult meant for promoting cattle fertility. It is even possible to go one step further and say that the Neolithic groups, without ever really meaning so, raised from garbage disposal virtual monuments dotting the landscape in a prominent way (Paddayya 1993: 597, 2005; see also Johansen 2004). It is probable that the major ashmound sites with their imposing mounds witnessed periodic regional congregations of Neolithic groups, facilitating many functional and ceremonial transactions and also fostering cultural identity among groups scattered over large areas. Allchin rightly concluded his study with the assertion that the phenomenon of ashmounds of Southern Deccan and the burnings that produced them "add a new and peculiarly Indian chapter to the history of human institutions" (Allchin 1963: 178). The ashmound studies constitute a fine example of the advantages of employing both adaptational and interpretive perspectives for investigating the first agro-pastoral communities of the subcontinent.

Acknowledgement
I am grateful to Prof. V.N. Misra for his helpful comments which are incorporated in the text.

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Hossein Negaresh *et al., Man and Environment* XXXVI(2): 20-27 [2011].
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Identification of Structure and Morphology of Raised Beaches in Southeastern Iran by the Application of Physical and Chemical Methods

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Abstract

Raised beaches are found in Iran all along the Oman Sea, where they extend from the suburb of Jask Port to Gowatre Bay, right into Pakistan. The beaches started developing some thirty to fifty thousand years ago. Their growth rate has been calculated to be one to three millimetres a year. The rate of uplifting increases steadily from west to east; it is nearly one metre at Jask Port, rises to more than a 100 m in the suburbs of Chabahar Port and goes up to 500 m at Karachi port. The origin and spread of these beaches have not been studied so far. In the present paper the authors report the findings of their investigation into the structure and morphology of these beaches. Characterization of samples by X-Ray diffraction (XRD), BET measurement and thermal analyses like TGA and DSC, along with analytical measurement, using Flame Atomic Absorption (FAA) have been carried out to determine the type and origin of the beaches.

Introduction

The raised beaches are an uncommon geomorphologic phenomenon. So far, a lot of discussion and debate has taken place on this topic. The manner of their raising has prompted great division of opinion amongst scholars. Some believe that the step-like beaches are a result of tectonic and subduction activities; hence they are called raised or uplifted beaches (Falcon 1947). Another group of scientists considers the transgression and regression of the seas in the past to be the main factors for creating such beaches for which they have been named marine terraces (Little 1970).

While studying the geomorphology of beaches in the region, attention should be paid to a very delicate and sensitive point, namely that all over the world, beaches have had a vertical fluctuation of more than a hundred metres because of changes in levels of sea waters throughout the Quaternary period (Kelletat 1999). However, the process of beach-raising started some thirty to fifty thousand years ago. This process is still active.

Throughout the stretch of the Oman Sea, uplifted land can be seen on beaches starting from about the Port Jask to Karachi Port in Pakistan which are called "raised beaches" in this paper. For a better understanding, it is necessary to know that 'Marine Terrace' is a common terminology which is applied to step-like features that have occurred due to fluctuations of levels throughout the coastlines whereas the expression 'raised beaches' is only used for those beaches that have come into being by virtue of tectonic and subduction activities. As such it may be stated that any uplifted beach can be a Marine Terrace but all terraces cannot be considered as Raised Beaches (Negaresh 1999).

Each beach has a length and width of several kilometres, surrounded by very steep crags. Beaches are constantly emerging and are closely connected with neo-tectonics of the region. Regarding the significance of the raised beaches, Hills (1949) has stated that unless we properly comprehend the raised beaches, discussion regarding relative earth and sea movements would obviously be futile.

Many studies on raised beaches have been carried out in Iran; most of these relate to their genesis, manner of occurrence rate, uplift and features (step-like or otherwise etc). No one has attempted

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Received : 09-10-2010
Revised : 22-12-2010
Accepted : 02-09-2011

to investigate their true origin. Even their primary origin is still wrapped in obscurity. The aim of this article is to identify the origin of raised beaches in southeastern Iran using physical and chemical analysis and to determine whether or not they have their origin in the sea or not. In other words, is there any analogy between sediments of existing beaches and neighbouring coastal ranges?

The Process of Formation of Raised Beaches and their Characteristics

The raised beaches around Chabahar Bay (which itself is considered a part of a raised beach of Oman sea), from Jask up to Karachi port, have been created due to subduction of the oceanic shell beneath the continental shell (Hosseini-Barzai and Talbot 2003). The phenomenon of rising beaches not only caused the appearance of rock beaches and horse shoe gulfs in this area and other areas along the Makran coast, but it also led to a shift and refraction in sea waves and produced various uneven and rough areas (Negaresh 2006).

There are many reasons to prove that rising beaches are a result of tectonic effects in the study area. These reasons are as follows:

1. Animals and plant on the upper surface of the raised beaches, are similar to those on the present beaches.
2. The signs and effects of wave erosion are evident at underwater erosion surfaces which now are seen as raised beaches. On the other hand effects of wave erosion on the upper surfaces of the raised beaches are similar to those seen at present.
3. The existing holes on the upper surfaces of the raised beaches are similar to those seen on present beaches.
4. The existence of young and V shaped valleys in the mountains near the beach.
5. The existence of neaps in the upper surfaces of the raised beaches as this feature is only produced by crashing of sea waves along a cliff slope.
6. The raised beaches are stepped and flat, which represents different stages of rising and fault thrusting at different times.
7. If we suppose that the existence of different surfaces in the raised beaches are due to eustatic processes. The age and height of all the raised beaches in Iran and Pakistan would necessarily be the same. However, this is not so. The effects of rising and falling of the sea levels would be observed in coastal plains and hill sides. Moreover, the effects of such different levels shall be observed in the southern beaches of the Persian Gulf and the Oman Sea, although up to now, no report has been received of the same.
8. The existence of active mud volcanoes, earthquakes and various movements are signs of active tectonics, and of a moderate rising of the area.

These effects are only observed in beaches of this area and can be found to lesser extent on beaches of the Persian Gulf well as coastal plains and mountains, therefore, with respect to above reasons, these beaches have tectonic origin and they are not arising from eustatism. The following characteristics can be observed (Negaresh 2006):

1. In Iran, these beaches begin from Bandar Jask and continue up to Karachi Port in Pakistan.
2. The stepped shape of most of these beaches is a characteristic, although, non-stepped beaches can also be found in them.
3. Their height usually from west to the east and around Bandar Chabahar and its valley; their approximate height reaches about 100 m.
4. These beaches are mostly covered by marl and lime sandstones together with particles of sea shells. In some parts a weak conglomerate layer with thickness 2-7 m covers them and is steeped toward the sea.
5. The age of these beaches goes back to about 30-50 ka (Negaresh 2004).
6. The rise of these raised beaches is estimated to be about 1-3 mm/year or more precisely 1.63-3.37 mm/year.
7. Raised beaches are wholly dominant on the sea as the cliff and constitute the active sea deposits of the area.

Research Background

Up to now, several people have investigated the raised beaches of Iran for different objectives Blanford (1872), Pilgrim (1908), Tipper (1921). Later, raised beaches of Makran, Iran were studied and reviewed by Harrison (1941), Snead (1997), and Falkon (1997), and three levels of terrace of different heights were recognized. These investigations were continued by Little (1970), and for the first time, the age of eight samples of the existing sea shells in the raised beaches of Iran and Pakistan were determined using ^{14}C methods.

In order to select a proper place for the establishment of atomic power plants, more complementary studies were made along Makran beach, in Iran and Pakistan. In this research, the age of 22 samples of sea shells were determined using ^{14}C methods. The results confirmed uplift of this area (Ghorashi 1985). Davies *et al.* (2009) studied on the age and stratigraphy of raised beaches of Easington, Dorham, England and Benedetti *et al.* (2009) have studied raised beaches of Late Pleistocene in the centre of the Portugal. Santoro *et al.* (2009) studied the raised beaches of north Calabria, Italy.

Ghorshi (1984), Samadiyan (1981), Kousari (1985) and Negaresh (1995) from Geological Survey of Iran and other educational and research institutes have studied raised beaches, but these studies were not adequate. There are many ambiguities and uncertainties in these studies which necessitates more work.

Research Method

In this study, physical and chemical analysis has been used to investigate and identify the structure and morphology of sediments with an objective to comprehend the origin of raised beaches in Iran. Hence, the Chabahar Bay in southeastern Iran was selected as the study area. Four samples of sediments were collected (March 2004) from existing beaches and from the raised and also step-like beaches, adjacent to the present sea, known as uplifted beaches. The structural and morphological investigation using different physical methods such as X-Ray diffraction (XRD), BET surface area, Thermal Gravimetric Analysis (TGA) and Differential Scanning Calorimetriy (DSC) were used to characterize the samples and Flame Atomic Absorption Spectroscopy (FAAS) was applied to analyse different samples for determining the primary origin of elevation at the periphery of the sea.

Location of Samples (Fig. 1)

Following four samples were collected:
Sample No. 1: 100 m from the coastline.
Sample No. 2: 200 m from the coastline.
Sample No. 3: 4.5 km from the coastline at 50 m height.
Sample No. 4: 6 km from the coastline at 70 m height.

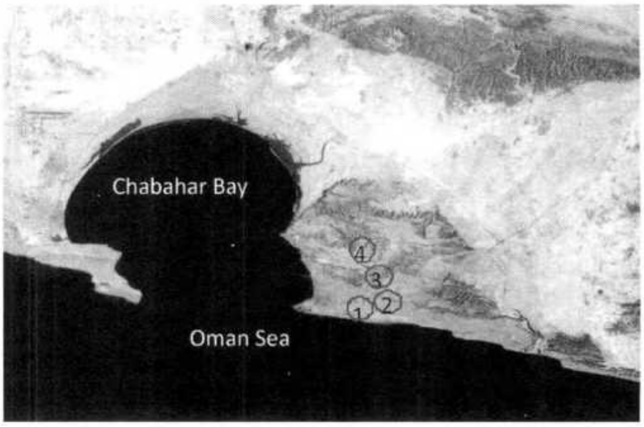

Fig. 1: Geographical location of the region under investigation and the sampled areas

X-Ray Diffraction (XRD)

Powder X-ray diffraction (XRD) measurements were performed using a Bruker axs Company, D8 Advance diffractometer (Germany). Scans were taken with a 2θ step size of 0.02 and a counting time of 1.0s using CuK_α radiation source generated at 40kV and 30 mA. Specimens for XRD were prepared by compaction into a glass-backed aluminum sample holder. Data was collected over a 2θ range from 4° to 70° and phases were identified by matching experimental patterns to entries in the Diffraction Version 6.0 indexing software.

BET measurements

Brunauer-Emmett-Teller surface area BET measurements were conducted using a micro metrics adsorption equipment (Quanta chrome instrument, model Nova 2000, USA) determining nitrogen (99.99% purity) as the analysis gas and the samples were slowly heated to 300 for 3h under nitrogen atmospheric. Prior to analysis each samples measurements specific surface area was evacuated at -196 °C for 66 minutes.

Thermal Gravimetric Analysis (TGA) and Differential Scanning Calorimetriy (DSC)

The TGA and DSC were carried out using simultaneous thermal analyzer apparatus of Rheometric Scientific Company (STA 1500+ Model, England) under a flow of dry air. The temperature was raised from 25°C to 800°C using a linear programmer at a heating rate of $10^{\circ}C\,min^{-1}$. The sample weight was between 10 and 25 mg.

Chemical Analysis of the Samples

All samples analyzed using a Flame Atomic Absorption Spectroscopy (FAAS) (England, Philips, pu9100X).The specific hallow cathode lamp was used to determine the existing elements in the different samples.

Results and Discussion

All samples were analyzed by flame atomic absorption and results indicated similar elements (Table 1). Characterization studies were carried out using various techniques for all samples. The X-ray diffraction patterns of these materials are shown in Fig. 2.

The actual phases identified for Sample-1 was $CaCO_3$ (monoclinic and orthorhombic), K (cubic), Na (Cubic), Fe_2O_3 (cubic), CuO_2 (cubic) and Cu and for Sample-2 was Na (Cubic), K (cubic), Li (Cubic), $CaCO_3$ (monoclinic, orthorhombic and rhombohedral), CuO_2 (cubic), and $caFeO_3$ (tetragonal) and the actual phases identified for Sample 3 and 4 were $CaCO_3$ (monoclinic and orthorhombic), CuO_2 (cubic) and $CaFeO_3$ (tetragonal) (Table 2).

The X-ray diffraction patterns for these samples were similar, although the relative diffracted intensities from the phases were slightly different and patterns showed the composition of all samples are very similar, thus the source of the all samples is the same. Characterization of these samples was carried out using TGA to measure the losses of weight as the temperature of the sample is increased and also by DSC analysis to determine the enthalpies of changes in physical state, i.e., transition from one crystalline form to another. Whenever a material undergoes such change, heat is either absorbed or liberated.

Table 1: Flame atomic absorption results for samples 1-4

Sample No.	Elements
1	Ca, K, Na, Fe, Cu
2	Ca, K, Na, Fe, Cu, Li
3	Ca, K, Na, Fe, Cu
4	Ca, Na, Fe, Cu

Table 2: XRD results for samples 1-4

Sample No.	Phases
1	$CaCO_3$ (monoclinic and orthorhombic), K (cubic), Na (Cubic), Fe_2O_3 (cubic), CuO_2 (cubic) and Cu
2	Na (Cubic), K (cubic), Li (Cubic), $CaCO_3$ (monoclinic, orthorhombic and rhombohedral), CuO_2 (cubic), and $caFeO_3$ (tetragonal)
3	$CaCO_3$ (monoclinic and orthorhombic), CuO_2 (cubic), K (cubic) and $caFeO_3$ (tetragonal)
4	$CaCO_3$ (monoclinic and orthorhombic), CuO_2 (cubic) and $caFeO_3$ (tetragonal)

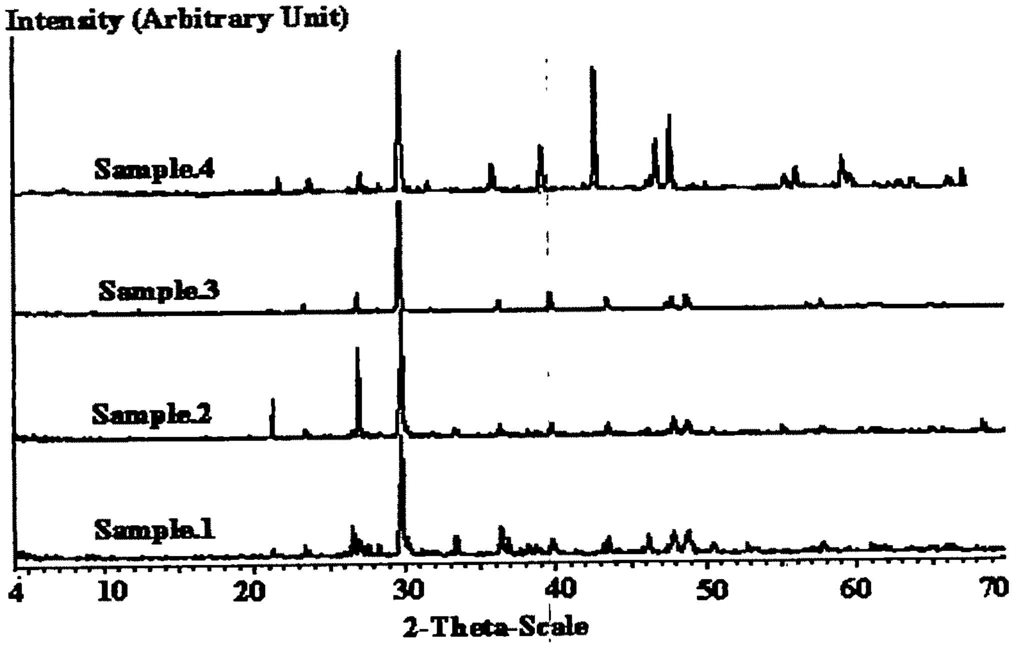

Fig. 2: XRD patterns for samples 1-4

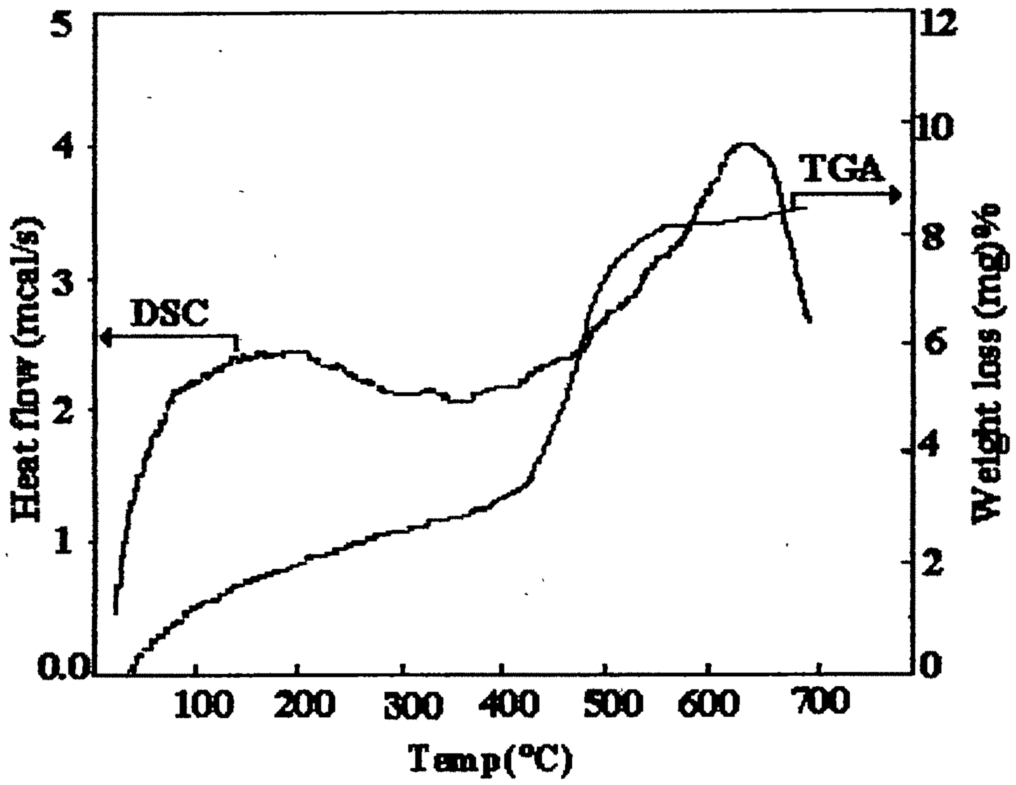

Fig. 3: TGA and DSC curves for Sample 1

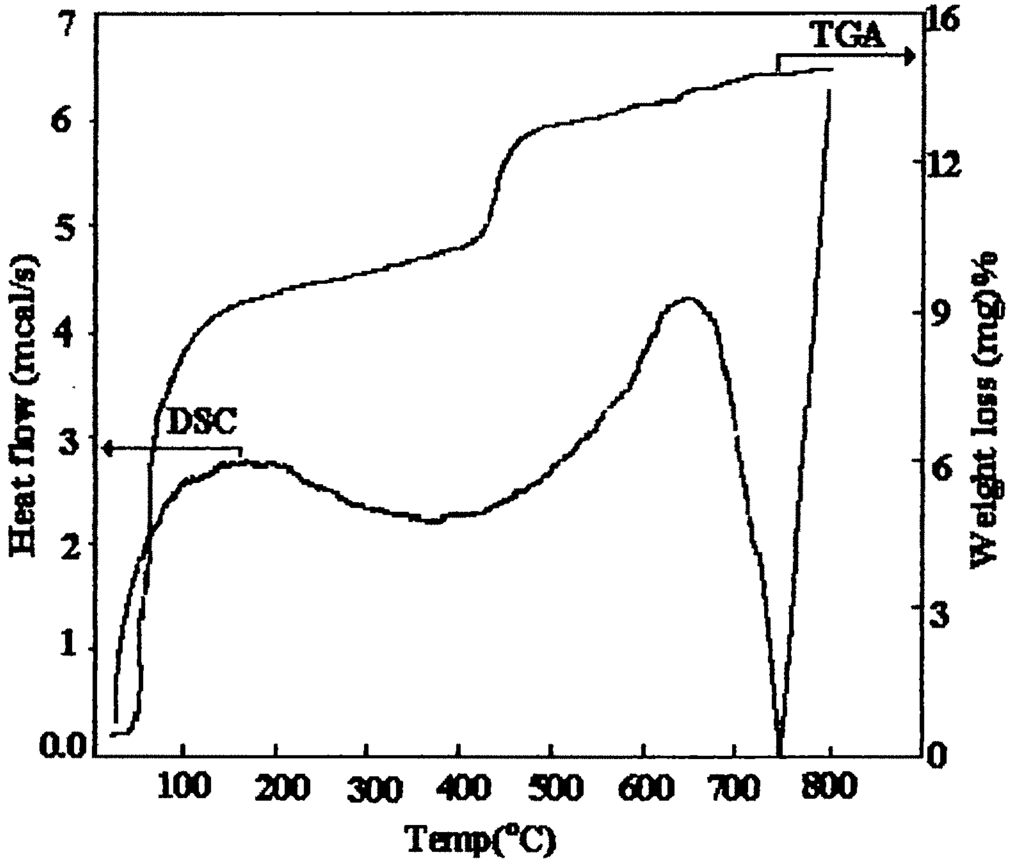

Fig. 4: TGA and DSC curves for Sample 2

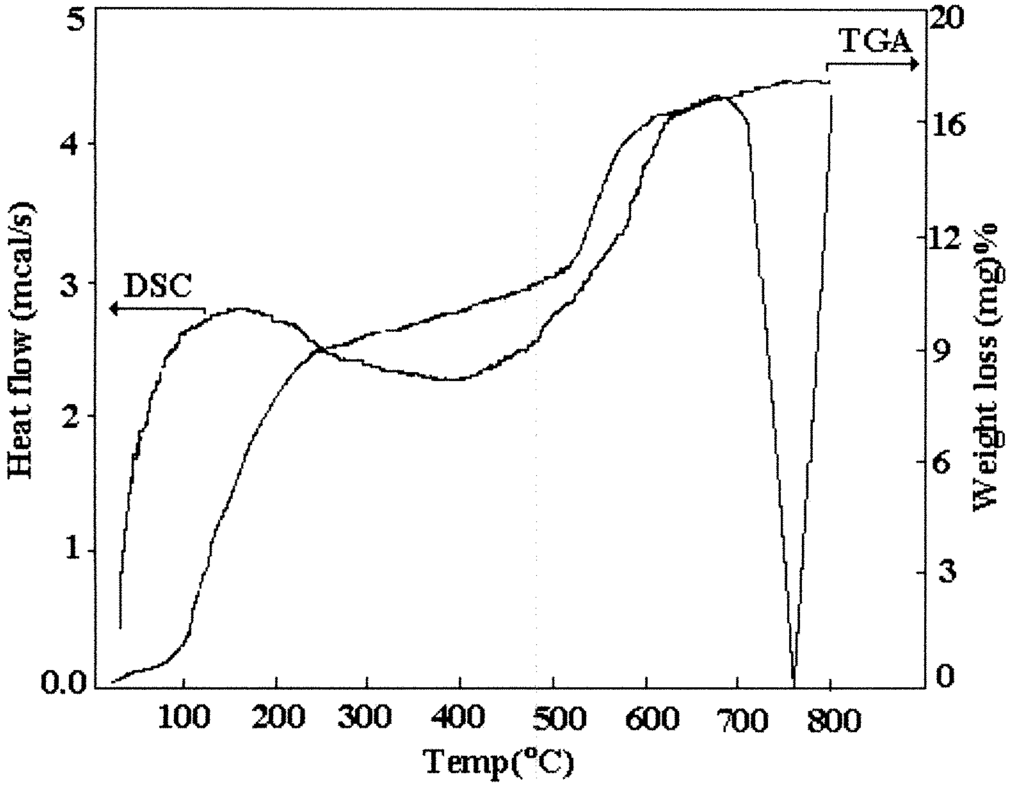

Fig. 5: TGA and DSC curves for Sample 3

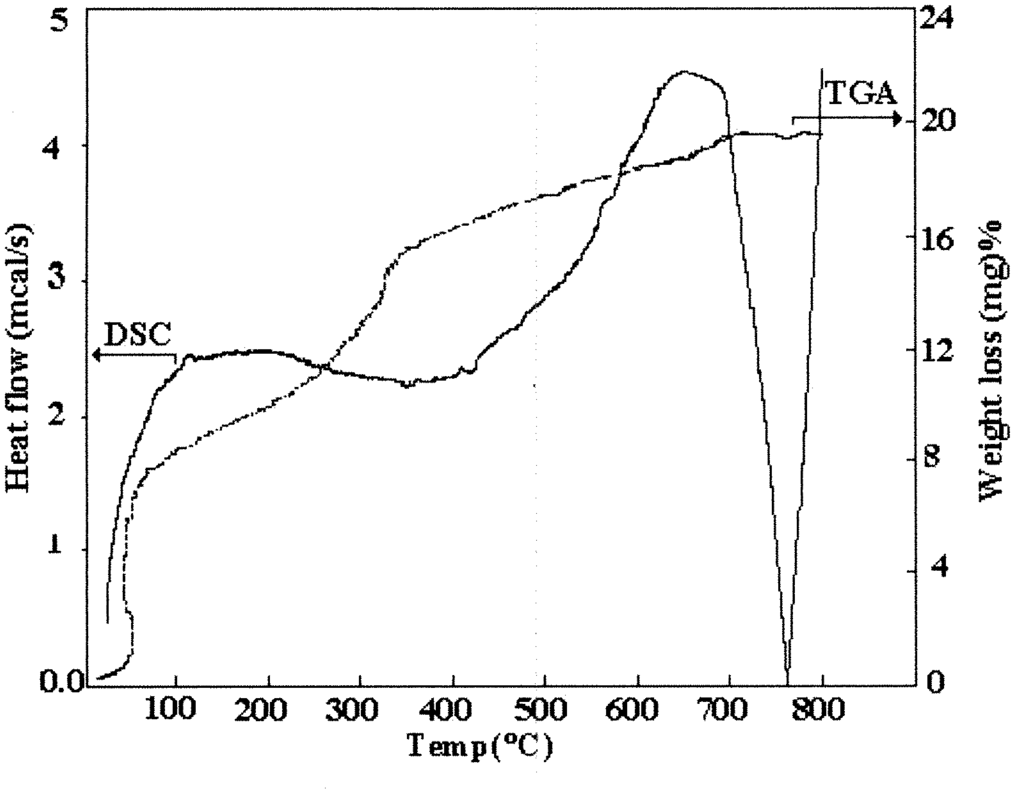

Fig. 6: TGA and DSC curves for Sample 4

Table 3: BET results for samples 1-4

Sample No.	Specific surface area (m^2/g)
1	51
2	50
3	53
4	55

This process can be initiated simply by raising the temperature of the material. This temperature is usually programmed to scan a temperature range by increasing linearly at a predetermined rate. The TGA and DSC curves for these samples are shown in Figs. 3-6. All samples show two main thermal effects, the first effect, weight loss occurs with onset temperatures around 70-180°C is due to the removal of absorbed water and the decomposition of crystalline water or basic carbonate and second effect, around 440-560°C for samples1 and 2 and for sample 3 around 450-750°C and for sample 4 around 250-750°C due to decomposition of carbonate phases. The samples were characterized also using DSC and show two main change in agreement with TGA results. The BET specific surface results for these samples are listed in Table 3.

As it can be seen, the BET specific surface areas for all samples almost equivalent the results obtained from the BET, TGA and DSC techniques are in agreement together and also with XRD results. Thus, the source of the all samples is similar and they have almost the same structure and morphology and there is an analogy between the sediments of existing beaches and also neighbouring coastal ranges.

Conclusion

The beaches of the said region have started rising nearly 30-50 ka years ago. An uplift of 1-3 mm has been annually recorded in their height, while their uplift rate has been observed from west to east. The original site of raised beaches starts from the suburbs of the Strait of Hormuz and goes towards the coasts of the Oman Sea, but they exhibit a clear feature from Jask to Karachi Port in Pakistan. raised beaches in Iran are, if not unequalled in the world, rare and exclusive. Most of the world's Marine Terraces have a eustatic origin. However, the raised beaches in Iran have a tectonic origin while the role of subduction and tectonic activities has been greater than the eustatic process in their formation. The results of XRD studies indicated the phases of for 4 samples are very similar that pattern of XRD confirmed this results and the BET specific surface area for all samples to almost equivalent that confirmed by results for XRD and thermal analysis pattern for all samples have similarly thermals effects that confirmed by results for XRD and BET. Thus, the source of the all samples is similar and they have almost similar structural and morphology and there is an analogy between the sediments of the existing beaches and neighbouring coastal ranges.

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Kulatilake, Samanti, *Man and Environment* XXXVI(2)· 28-34 [2011]
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Cranial Diversity among South Asians: A Global Perspective

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Abstract

The appearance and spread of modern humans in South Asia has been a topic discussed by cultural and biological anthropologists, archaeologists, and linguistic anthropologists. Of interest is the apparent geographic proximity of South Asia to the regions in Africa, now thought to be the cradle of modern human origins. South Asia is a region that has been successively migrated into by expanding human populations. The cultural and biological diversity seen among South Asians today is largely a result of the diversity that would have existed among the incoming populations. Cranial diversity as observed through craniometric variation among South Asian and global populations is explored and the observed patterns are discussed in connection with the origin and dispersal of modern humans and the local history of South Asia.

Introduction

The origins of modern humans, the processes that have led to their diversity as well as the timing and nature of their dispersals that populated the world, are topics of significant interest. Molecular and fossil evidence indicate that after a local African origin, modern humans have dispersed to populate the world, and by early Holocene times vast areas of the globe have been occupied (Cann *et al.* 1987; Cavalli-Sforza *et al.* 1994; Lahr and Foley 1998). There is archaeological and fossil evidence that the South Asian subcontinent has been occupied by modern humans from Late Pleistocene times. While researchers have attributed this early occupation to *in situ* evolution within Asia (Hawkey 1998; Kennedy 2000), evidence for the contrary has been accumulating over the past decade, suggesting dipersals from other regions of the world (Quintana-Murci *et al.* 1999; James 2007; Stock *et al.* 2007). South Asia is a region that has been successively migrated into and has been a source of dispersals to other parts of Asia (Bowles 1977; Majumder 1998; Mellars 2006a and 2006b; Fields *et al.* 2007). As a region with a distinctive cultural identity as well as one enriched by adjacent regions, the study of the biological anthropology and the evolutionary history of its peoples have yielded fascinating information so far.

Fossils of the earliest anatomically modern humans have been discovered from eastern and southern Africa, and from the Middle East. Competing hypotheses accounting for the origin of modern humans have been developed, but on the basis of fossil and molecular evidence, a recent African origin of modern humans is the view that is currently supported by the scientific community. Archaic forms, termed *Homo heidelbergensis* who were the immediate ancestors of anatomically moden humans were relatively robust in their cranial and postcranial structure and possessed less sophisticated technologies than moderns (Rightmire 1998). The rich fossil record of Africa attests to this transition from the archaic to the anatomically modern (Aiello 1993; Stringer and MacKie 1996). Modern humans appear in the fossil record in parts of Eurasia much later in time.

Of critical interest is the apparent geographic proximity of South Asia to the regions in Africa, now thought to be the cradle of modern human origins. It has been proposed that modern humans dispersed out of Africa through two major routes: through North Africa, the Middle East towards Eurasia, and secondly taking a southern route through Ethiopia and the Arabian Peninsula towards South Asia, and on to Australia (Lahr and Foley 1998; Stringer 2000; Walter *et al.* 2000). It is suggested that genetic traces of the second hypothetical route may be detected in Southeast Asia and perhaps also in the southernmost parts of South Asia. There is archaeological and fossi

Received : 24-02-2011
Revised : 12-05-2011
Accepted : 10-06-2011

evidence indicating that South Asia was occupied by modern humans, from late Pleistocene times (Deraniyagala 1992; Kennedy 1999; Kourampas *et al.* 2008; Perera 2010).

Following analysis of cranial data of recent peoples from South Asia and adjacent regions, it was proposed that the inhabitants of South Asia today are probably the descendants of more recent migrant populations to the region, and that the diversity seen among them is a result of these migrations combined with other evolutionary mechanisms (Kulatilake 1996).

The cranium is especially useful for biological anthropologists, as it is recognised that the cranial shape of ancestral populations is inherited by individuals of subsequent generations (Howells 1973; Lahr 1996). Hence, a study analysing cranial variation can help reconstruct the evolutionary patterns that shaped the recent diversity seen among a population. Bearing this in mind, in this research, the methods and techniques used to study cranial variation are applied to the cranial remains of peoples from South Asia (n = 284). This study takes into account the cranial diversity seen among South Asians from prehistoric to recent times. The recent sample includes people of the Ganga plain (NE India/Bengal/Bangladesh) Indus plain (NW India/Pakistan), South India, Sri Lanka (Sinhala, Tamil, Vedda). The ancient sample is comprised of skeletal remains from historic, proto-historic, prehistoric sites of South Asia.

Standard craniometric methods and techniques (Howells 1973) were used to collect data on cranial samples from South Asian populations from recent, mid Holocene and early Holocene/Late Pleistocene times. Univariate and multivariate statistical measures were used in the study. The results obtained from multivariate analyses – specifically Principal Component Analysis (PCA) are discussed in this article. Since PC 1 often encodes for cranial size differences, PC 2 (*x* axis) and PC 3 (*y* axis) are plotted in the graphs to infer cranial shape dimensions.

Recent South Asians and Adjacent Populations

Craniometric data in this study showed that the recent South Asians possess more protruding mid-facial regions, narrower cranio-facial dimensions, high vaults and greater cranial length. More specifically, when compared to Southeast and East Asians, the recent South Asians have greater mid-facial protrusion and narrower, longer crania. Compared to the Africans, they have greater mid-facial protrusion, higher vaults and longer crania. The crania of South Asians are relatively smaller and gracile in comparison with the robust and large crania of the Australo-Melanesians. Also, the South Asians differ from the Australo-Melanesians in possessing greater mid-facial protrusion, but a lesser degree of sub-nasal prognathism. In comparison with the Europeans, the South Asians have smaller crania, which appear to be more prognathic with narrower faces. Although very similar to Middle Eastern populations, subtle differences are seen in cranial breadth and sub-nasal prognathism.

The patterns of differences between South Asians and other regional populations are illustrated in Fig. 1. This diagram is based on the analysis of cranial shape. The distribution of recent South Asians covers less morphospace compared to other regional groups, and no outliers are seen. This indicates that the recent South Asians are fairly homogeneous. Several other populations are more variable or heterogeneous, and fill a greater area of morphospace as represented by this type of analysis. There are also outliers among Europeans, sub-Saharan Africans and Southeast/East Asians. These recent populations seem to be less homogeneous than the South Asians.

The recent South Asians appear to be more closely related to Middle Easterners – their neighbours on the West- than to their Eastern neighbours. These findings fit well with the evidence from the archaeological record, historic sources and genetic studies, which show that South Asians have shared many cultural and biological links with Middle Easterners, which outweigh the connections maintained with Southeast/East Asians.

Mid/Late Holocene South Asians and Adjacent Populations

Whereas the recent South Asians are relatively homogeneous, as one goes back in time, they become increasingly heterogeneous (Fig. 2). South Asians that fall within Historic, Bronze Age and Neolithic time frames have average cranial dimensions in relation to their contemporaries in Europe, Southeast Asia, sub-Saharan Africa and Melanesia. This is implied, as they occupy a central position in the diagram, where cranial shape is considered. In general, the Mid/Late Holocene South Asians share certain features with Melanesians, Middle Easterners and sub-Saharan

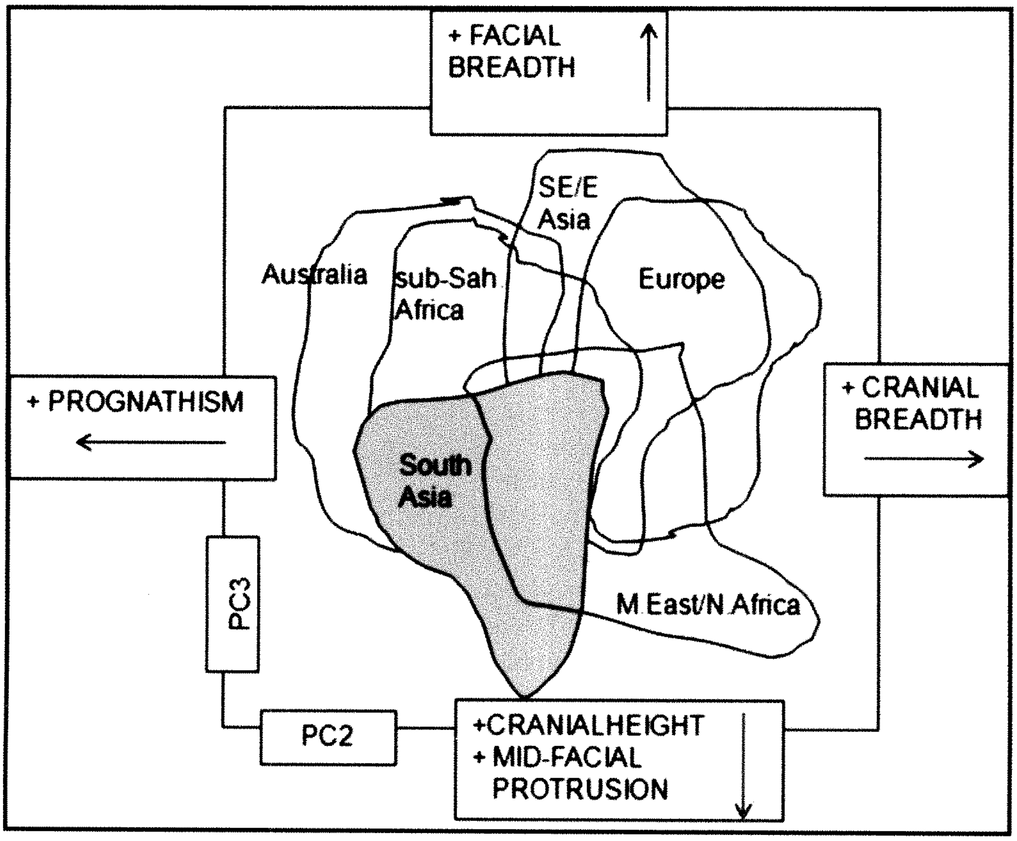

Fig. 1: Recent South Asians: relationships with contemporary global populations

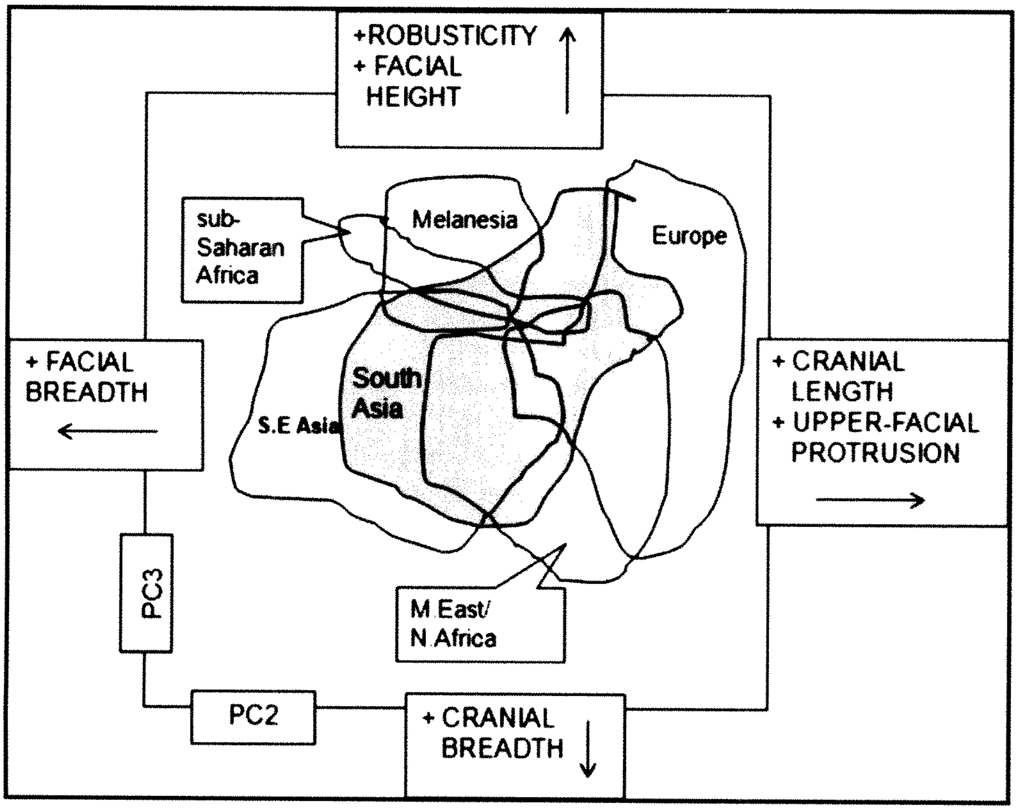

Fig. 2: Mid/Late Holocene: relationships with contemporary global populations

Africans, while a lesser degree of similarity is seen between South Asians, Southeast Asians and Europeans.

Early Holocene/Upper Pleistocene South Asians and Adjacent Populations

The morphology of the Mesolithic South Asians (*c.* 8-12 *ka*) is shared by Middle Easterners/North Africans, sub-Saharan Africans and Europeans who belong to this period (Fig. 3). In certain aspects, the ancient South Asians are also similar to the ancient Australians. There is less overlap between the South Asians and Southeast/East Asian people of this time span. In other words, there appears to be a relative homogeneity among Late Palaeolithic and Mesolithic populations, with evidence for links across to the west with both Europe and Africa. This may reflect that these populations share a common source related to population expansions during the post-LGM. Kennedy, Chiment *et al.* (1984) using 12 variables of the cranium have shown that similarities exist between the Cro-Magnons and Mesolithic South Asians, which they attribute to convergent evolution among populations living in similar harsh environments.

Much attention has been paid to Neolithic agricultural expansions from the Middle East towards South Asia. However, before those events, populations sharing cultural and biological affinities with the Middle Eastern/North African Mesolithic groups would have peopled regions of South Asia. Thus, the Mesolithic South Asians who share morphological affinities with the Middle East/North African Mesolithic groups and Mesolithic Europeans may represent the peoples who dispersed during these early expansions.

During this period, the morphology that defines the Southeast/East Asian peoples does not overlap much with that of the South Asians. These regional groups may not have shared the same gene pool and would have been relatively isolated during the LGM (Last Glacial Maximum). Perhaps the Early Holocene/Upper Pleistocene South Asians and Southeast/East Asians would represent independent expansions from a diverse source. However, as described above, the Mesolithic South Asians are more closely linked with the Middle Easterners and Europeans belonging to this time, indicating closer genetic and cultural affinities. The infiltration of peoples sharing affinities with the Southeast/East Asians to the northeastern sector of South Asia would have been a relatively later event when environmental conditions favoured expansions into South Asia from the east, via Assam. Furthermore, narrowness

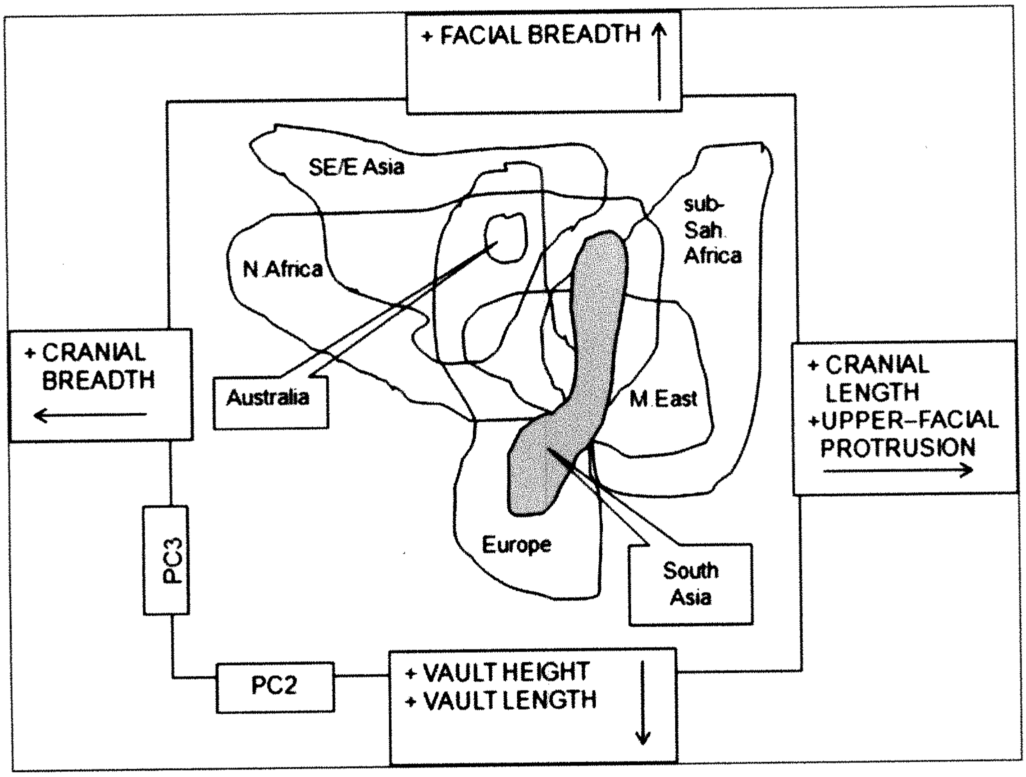

Fig. 3: Early Holocene/Upper Pleistocene: relationships with contemporary global populations

of the face and vault length are characteristics that distinguish recent South Asians from Southeast and East Asians. These characteristic features could be traced back to the Early Holocene/Upper Pleistocene, where South Asians appear to have relatively narrower faces, longer, higher vaults than their contemporaries in Southeast/East Asia.

Summary and Conclusions

During each time span considered in the analysis of South Asians in the global context, they appear in the centre of the distributions amidst other contemporary regional populations. In cranial size and shape they exhibit average proportions when compared to other groups. This could be due to the influence the South Asians have received from populations of several adjacent geographic regions, as they occupy a central position in the Old World. Admittedly, the analysis of Mid/Late Holocene and Early Holocene/Upper Pleistocene South Asians takes into account only a limited number of features. However, the analysis of recent populations uses a wide range of cranial features, and so the variability seen between regional populations is relatively robust.

Fig. 4 shows a model of how diversification of human populations might have occurred in South Asia. The morphological homogeneity among recent South Asians is in contrast with the diversity seen among ancient peoples of the region. The Mid/Late Holocene South Asians in particular, are more diverse than the recent people. This could be due to the arrival of peoples possessing diverse biological characteristics from different geographic regions during Neolithic agricultural expansions and during historic expansions and invasions. Recent peoples from Southeast Asia and the Middle East are known to be fairly distinct morphologically, since the Middle Easterners are traditionally characterised as 'Caucasoid' and the Southeast Asians as 'Mongoloid'. Population expansions into South Asia would have accompanied the spread of agricultural practices and the introduction of domesticated crops originating in the Middle East and Southeast Asia during Mid/Late Holocene times. The relative isolation of people living in different parts of South Asia during Mid/Late Holocene times could be the reason for the diversity seen in their cranial morphology. Recent times however, have seen much homogenisation, which appears to have taken place due to admixture following contact between previously isolated groups.

In their cranial morphology, South Asians appear to share stronger links with the peoples to their west, from Early Holocene/Upper Pleistocene times through Mid/Late Holocene times to the present. Some of these connections during Mid Holocene (Neolithic) and Late Holocene (Historic) times are currently validated through archaeological, linguistic and genetic data. Further research in archaeology and biological anthropology, may shed light on the post-LGM movements of populations into South Asia, which might have contributed to the patterns of affinities seen in the cranial morphology of Early Holocene/Upper Pleistocene peoples of the region.

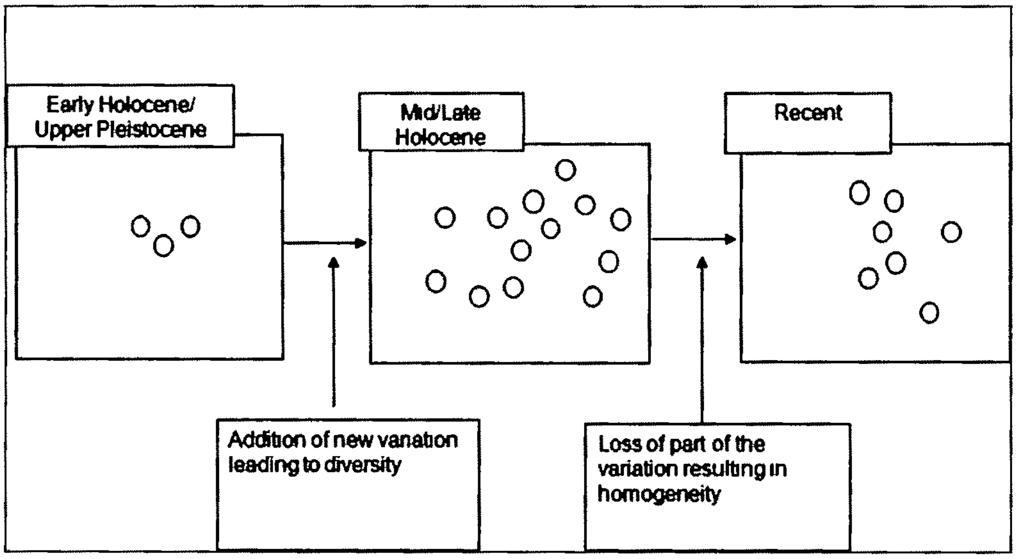

Fig. 4: Diversification of South Asian populations through time: processes which might have contributed to the diversity in cranial morphology

Acknowledgements
This research was funded by the Cambridge Commonwealth Trust, The Overseas Research Student Award Scheme, U.K and a Research Studentship from Corpus Christi College, Cambridge. I thank the curators and personnel of the following institutions for providing access to their collections: Duckworth Collection, Cambridge; British Museum of Natural History, London; National Museum, Colombo; Anthropological Survey of India, Kolkata; Allahabad University, Allahabad; Deccan College, Pune; University of Sri Jayawardenapura, University of Colombo and University of Peradeniya – Sri Lanka. The guidance offered by Prof. Robert Foley and Dr. Marta Lahr is kindly acknowledged.

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Srivastava, C. and D.P. Tewari, *Man and Environment* XXXVI(2): 35-44 [2011]
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Palaeoethnobotanical Finds from Ancient Naimisharanya, District Sitapur; U.P. during Kushana Period (A.D. 100-300)

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Abstract

The paper discusses the results of morphological investigations of seed and fruit remains from the ancient mound at Naimisharanya in district Sitapur of Uttar Pradesh, from Kushana Periods (approx. 100 to 300 A.D.) and their archaeological significance. The finds of seed and fruit remains are in carbonized as well as semi-carbonized states. The finds include cereals (barley, bread wheat and rice); minor crops like *sawan* and Italian millet; pulses (field pea, black-gram, green-gram and lentil); seeds of cucurbit/vegetable crop; along with seeds of cotton (*Gossypium* sp.) and silk-cotton (*Salmalia malabarica*). Seeds of custard apple, seed/fruit remains of neem (*Azadirachta indica*) and jujube fruit-stones have also been encountered. The evidence of neem (*Azadirachta indica*) seed/fruit remains, a medicinally valuable tree, is significant.

Weeds and wild taxa have also been encountered in association with field-crop remains. These belong to wild grasses such as *Andropogon* sp. (Blue stem grass), *Dactyloctenium aegyptium* (Crow-foot grass), *Eleusine indica* (Goose grass), *Panicum* sp. (Panicum grass), *Poa* sp. (Blue or Meadow grass); *Trianthema portulacastrum* (Lalsabuni) and *Indigofera hirsuta* (Hairy Indigo). *Dactyloctenium aegyptium* and *Trianthema portulacastrum* may have been the weeds in summer group crops like rice; where as *Indigofera hirsuta*, represent the weed component in winter crops like wheat and barley.

Introduction

Naimisharanya (27°21' 55" N; 80°29' 15" E), a famous sacred place, popularly known as Nimsar or Nimkhar is located on the left bank of the Gomati River, in District Sitapur of Uttar Pradesh. It is about 90 km northwest of Lucknow (Fig. 1).

Naimisharanya finds frequent mention in the Mahabharata (Veda Vyasa *Mahabharata*: Shantiparva 342/2), the Ramayana (Uttar Kand; Sarg 92/2,4,15) and most of the Puranas (e.g. Varaha Purana: 11/106-109). This place has many sacred tanks and temples. The forest of Naimisharanya (*Aranya* means forest in Sanskrit) is considered to be the forest manifestation of Vishnu and therefore, considered sacred. This place is described as being very holy and is stated to be very dear to Lord Shiva. It is said that during the course of history 60,000 sages lived there.

Naimisharanya is an important archaeological site where many sculptures, terracottas, brick structures and potsherds are found by local people while digging. Sri L.M. Wahal of the Archaeological Survey of India reported Ochre Coloured Pottery, Northern Black Polished Ware, Black slipped ware and Glazed ware from Naimisharanya (*IAR* 1969-70). O.C.P.(?), Black slipped ware, N.B.P.W., Sunga-Kushana pottery, a few shrines with domical roof and some Medieval sculptures from Chakra Tirtha (Naimisharanya) were also reported (*IAR* 1977-78).

Excavation at Naimisharanya

The department of Ancient Indian History and Archaeology, University of Lucknow explored 126 sites of archaeological importance in the district (Tewari 2004). Red ware and terracotta figurines were collected from the ground survey of the mound at Naimisharanya. With an objective to ascertaining the chronological sequence of cultures at the site and to collect data for reconstructing palaeoenvironments, archaeological excavations were carried out in 2007. Eight trenches were dug. Trench 3 dug in the northeastern part of Balaji temple was selected for collection of botanical remains from Kushana levels due to the presence of an undisturbed chronological sequence. In this trench half portion of a quadrant was excavated up to the depth of 6.0 m. It exposed a

Received : 27-12-2010
Revised : 22-01-2011
Accepted : 28-04-2011

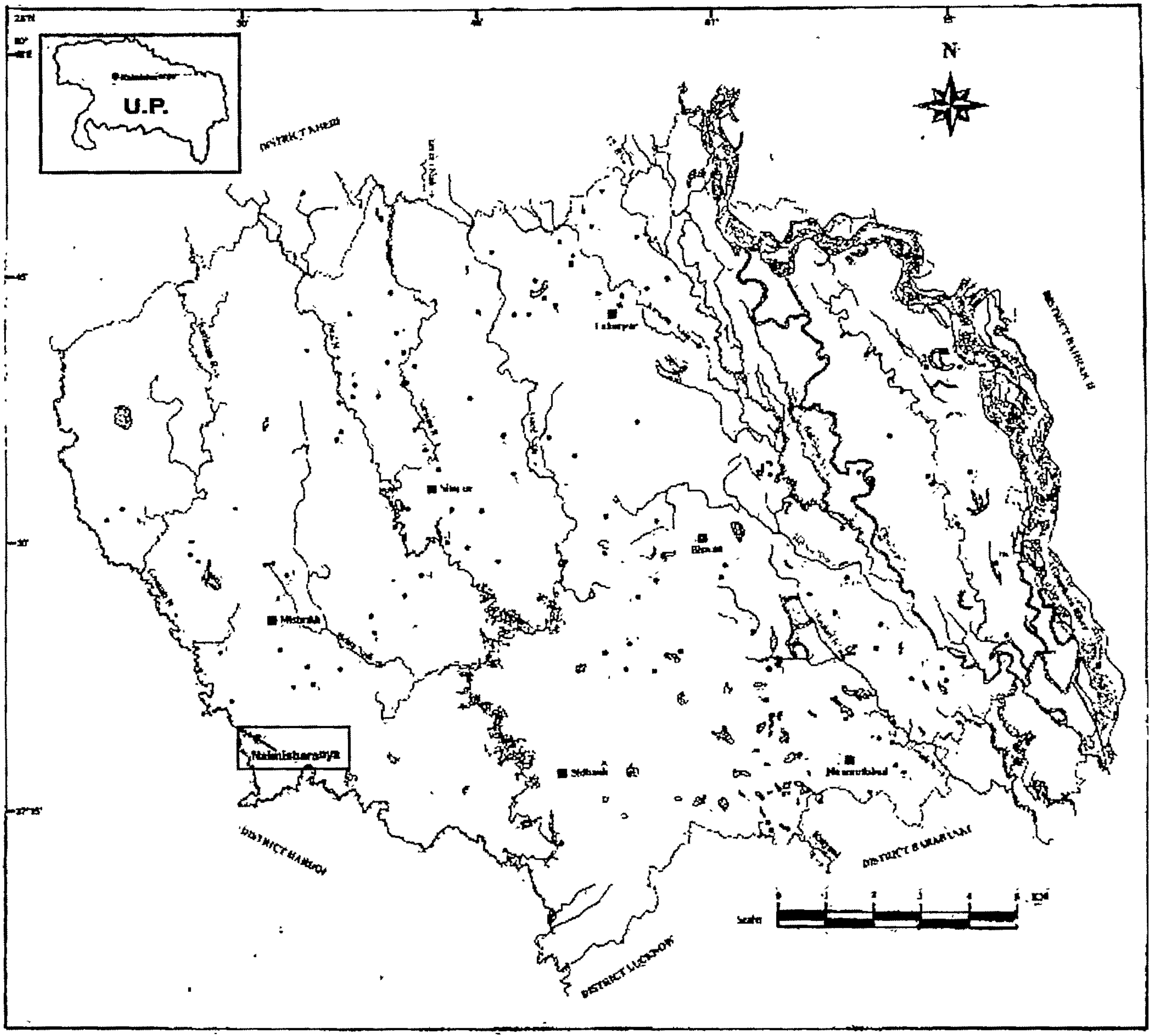
U.P.
N
DISTRICT KHERI
DISTRICT BAHRAICH
Laharpur
Biswan
Misrikh
Naimisharanya
Sidhauli
Mahmudabad
DISTRICT HARDOI
DISTRICT BARABANKI
DISTRICT LUCKNOW
Scale

Fig. 1: Location map of Namısharanya, Dist. Sitapur, U.P.

deposit of 8 layers. Layer 1 was Late Medieval, layers 2-5 were Early Medieval, and layers 6-8 were of the Kushana period.

A semi-carbonized sample of botanical remains was also collected from trench 4 (located in southern part of a Late Medieval mosque). On the basis of pottery and terracotta antiquities layer 1 was associated with the Early Medieval period, layers 2-5 were associated with the Kushana period and layers 6-7 were associated with the Early Historic period. On the basis of pottery and other archaeological material the following cultural sequence was established at the site:

Period I: Early Historic period with main pottery types-Orange red slipped ware, Red ware, Grey ware and Black slipped ware (no sherd of N.B.P.W.).

Period II: Kushana Period with Red ware.

Period III: Early Medieval Period with Red ware and Black ware.

Period IV: Medieval Period with Red ware and Glazed ware.

Material and Methods

Palaeo-ethnobotanical material for investigation was gathered by the first author (C.S.) as remains of field

Table 1: List of seed and fruit remains examined

S. No.	NSY Sample details	Crop remains	Weeds and wild taxa
1.	Trench 3, layer 8	Barley, Field-pea, Lentil Cotton, Jujube fruit-stone	Silk-cotton
2.	Trench 3, Layer 7	Barley,Green gram, Lentil, Rice	Gular fig/ fruit pieces, Neem Silk-cotton, Unidentified fruit capsule
3.	Trench 3, Layer 7	Barley, Field- pea, Cucurbit (Torai), Custard apple, Cotton	Neem Silk-cotton
4.	Trench 3, Layer 6	Barley, Bread wheat, Rice Dwarf wheat, Green gram Black gram, Jujube fruit-stone, Cotton	Hairy Indigo, Neem, Silk-cotton
5.	Trench 4, Layer 6 (Pit)	-	Blue-stem grass, Crow-foot grass, Hairy Indigo, Panicum grass, Foxtail grass, Lalsabuni

crops, associated weeds and wild taxa along with wood charcoal samples by floatation technique from the Kushana cultural horizon in two trenches (Tr. 3 and 4). The carbonized content of plant remains at ancient Naimisharanya was separated from the soil by floatation method (a water floatation recovery method. This way separation of organic remains from the soil matrix greatly enhances both the quantity and the range of botanical materials (in all size classes) that can be recovered. The material collected from trench 3 was in a carbonized state and a fair proportion were found in good state of preservation. The wood charcoal samples were collected for ^{14}C dating also. A total of five samples recovered from a single season's excavation were examined for plant remains (Table 1).

Seed and fruit remains were first cleaned with 5% glacial acetic acid and thereafter, repeatedly washed in water. Soil particles adhering to their surface were cleaned in acid alcohol (glacial acetic acid 10% + ethyl alcohol 50% in equal volumes) with the help of a soft hair drawing brush. Finally the grains were dried in normal condition.

In the laboratory seed and fruit remains were segregated and categorized under stereo-binocular microscope and their documentation done with the help of a digital camera. The finds of seeds and fruits investigated are dealt with here. Their identification is based on morphological grounds and comparison with their living counterparts.

Cereals

Oryza sativa Linn. (Fig. 2: a)

The grains, which are narrowly oblong, laterally flattened and prominently ribbed, have been found to measure 2.50 to 4.00 mm in length, 1.50 to 2.00 mm in breadth and 1.00 to 1.50 mm in thickness. The length, breadth and thickness (L/BxT) ratio falls above 2, which according to Vishnu-Mittre (Vishnu-Mittre1974) leads us to tentatively refer the grains to a cultivated form of *Oryza sativa* Linn., the only cultivated species in South Asia.

Hordeum vulgare L. emend Bowden (Fig. 2: b-c)

A number of elongated caryopses measure 4.00 to 5.50 mm in length, 2.00 to 3.00 mm in breadth and 1.50 to 2.00 mm in thickness. The ventral furrow originates from the base and gradually widens towards the upper end of the grains. The dorsal side is almost flat and the embryo rests on the beak like projection. The assemblage of grains shows the mixture of two types, some are larger with prominent bulging in the middle, while others exhibit ventro-lateral twists. In view of these characters, the grains from ancient Naimisharanya belong to hulled and six-row form of barley.

Triticum aestivum Linn. (Fig. 2: d-e)

Elongated grains with relatively narrower ends and thickest portion in the middle as well as near the embryo with smooth and somewhat rounded dorsal side compare to those of bread wheat. The grains measure 3.50 to 4.50 mm in length, 3.00 to 3.25 mm in breadth and 2.75 to 3.00 mm in thickness with hilum steeply placed on the dorsal side.

Triticum sphaerococcum Perc. (Fig. 2: f)
A few short and roughly oval-round grains with evenly rounded cheeks along with ventral, measure 3.00 mm in length, 2.50 mm in breadth and 2.00 mm in thickness. The grains with this peculiar appearance compare in all respect with those of dwarf wheat (*Triticum sphaerococcum* Perc.).

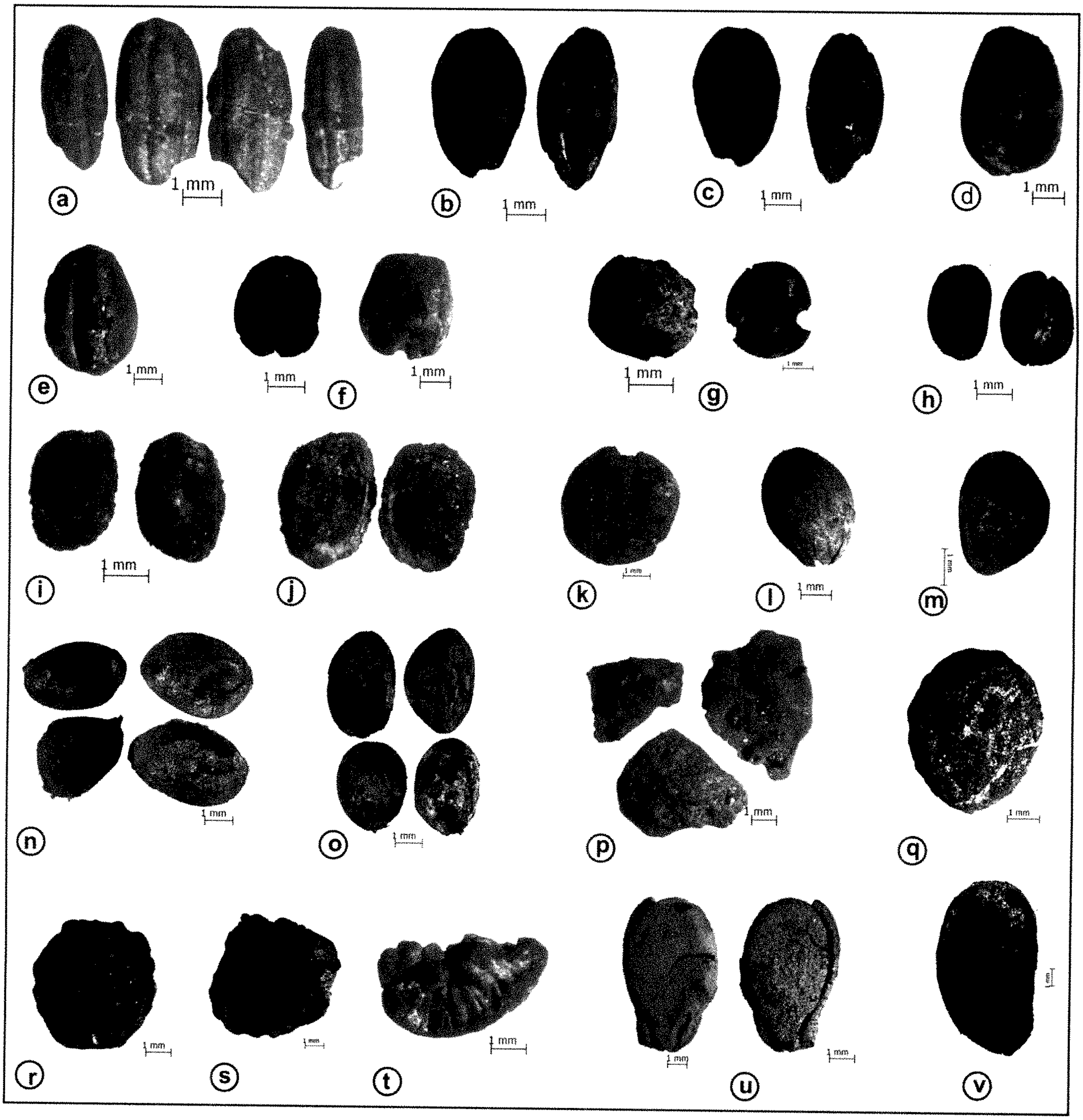

Fig. 2: a. Rice grains, b. Barley grains-ventral view, c. Barley grains-dorsal view, d. Bread wheat grains-dorsal view, e. Bread wheat grain-ventral view, f. Dwarf wheat grains, g. Lentil seeds, h. Black-gram seeds, i & j. Green gram cotyledons (dorsal and ventral view, K. Field-pea, l. Silk-cotton seed, m. Cotton seed, n. Silk-cotton seeds, o. Cotton seeds, p. Jujube fruit-stone pieces, q & r. Jujube fruit-stones, s. Jujube fruit-stone inner view, t. Gular-fig fruit (sysconium piece), u. Cucurbit seed, v. Custard-apple seed.

Pulses/legumes

Lens culinaris Medik (Lentil) (Fig. 2: g)
Few complete seeds which are circular and flattened with keeled margins, measure 2.50 to 3.00 mm in diameter and nearly 1.00 mm in thickness. The hilum is small and acutely lanceolate in shape.

Pisum arvense (L.) Poir (Fig. 2: k)
Spherical smooth seeds about 3.50 to 4.00 mm in diameter, hilum oval or ovate, 1.00 to 1.50 mm long, flush with the seed's surface and the chalaza is about 1.50 to 2.00 mm from the hilum; are comparable to Field-pea cultivated as a pulse crop.

Vigna mungo (L.) Hepper. (Black-gram) (Fig. 2: h)
A number of cotyledons and complete seeds appear sub-cylindrical to somewhat oblong in outline. The complete ones measure 3.00 to 4.00 mm in length, 1.50 to 2.25 mm in breadth and nearly 2.00 mm in thickness.

Vigna radiata (L.) Wilczek Green gram (Fig. 2: i-j)
Few seeds and cotyledons with elongated and somewhat cylindrical shape, measure 2.50 to 3.00 mm in length, 1.75 to 2.00 mm in breadth and nearly 2.00 mm in thickness. Both the seeds and cotyledons have squarish to rounded ends. Elliptical and flat hilum is situated at the level of the seed-coat surface.

Fruits

Ziziphus Juss. (Jujube) (Fig. 2: q-s and Fig. 3: d-e)
There have been recovered ellipsoidal carbonized fruit-stones measuring 5.00 to 6.00 mm and 4.00 to 4.50 mm in length and breadth respectively with tuberculated outer surface; resembling *Ziziphus mauritiana* Lam (Ber), a cultivated species under family Rhamnaceae. Jujube fruit-stone pieces of 3.50 x 2.50 mm up to 5.00 x 4.00 mm in size and with rugose surface have also been recovered; and identified up to generic level of *Ziziphus* species (Fig. 2p).

Annona cf. *squamosa* L. (Custard apple) (Fig. 2: v)
A few complete and half broken seeds measuring 12.00-13.00 mm in length, 6.50-7.00 mm in breadth and 4.50-5.00 mm in thickness have been recovered from the Kushana phase. Complete ones, smooth and oblong resembled those of *Annona* cf. *squamosa*. The characteristic ruminate endosperm was also observed in one of the half-split seeds.

Azadirachta indica (syn. *Melia azadirachta* L.) (Fig. 3: a, b, c, f and g)
The fruit is a smooth (glabrous) olive-like ellipsoid drupe which varies in shape from ovoid-oblong to nearly round, and measure 15.00-20.00 mm in length and 10.00-12.00 mm in breadth. The hard inner shell (endocarp) of the fruit encloses one, rarely two or three, elongated seeds (kernels) which measure 16.00-17.00 mm in length and 6.00-7.00 mm in breadth. The fruit and seeds seem to belong to neem (*Azadirachta indica*), a tree in the family Meliaceae. It is one of two species in the genus *Azadirachta*. Neem is native to India (Anonymous 1948-76).

Ficus glomerata Roxb. (Gular) (Fig. 2: t)
Carbonised fruit pieces, about 5.00 to 5.50 x 2.50 to 3.00 mm in size are comparable to those of Gular-fig (*Ficus* cf. *glomerata*), broken pieces of syconium. The fruit in Gular and other species of *Ficus* (family Moraceae), is produced by the union of the Cymose inflorescence to form a hollow, fleshy axis, bearing the flowers on its inner surface.

The seeds oblong-elliptic in outline and measuring 1.00 to 1.50 mm in length and 1.00 mm in breadth and thickness have been referred to the seeds (tuberculate achenes) of *Ficus glomerata* Roxb., of family Moraceae, which is characterized for having arched or bend position of the embryo in fleshy endosperm like the above seed remains (Martin and Barkley 1961*)*. It is very common around the area of investigation.

Vegetable Crop

Luffa sp. (Torai) (Fig. 2: u)
Single seed measuring 8.00 mm in length and 5.00 mm in breadth, compressed/flattened, elliptic, rather broader one end; furnished with four grooves and small conical points resemble *Luffa* of family Cucurbitaceae. The seed recovered belongs to either of two species of *Luffa* viz. *Luffa aegyptiaca* Mill. and *L. acutangula* Roxb. which are considered to be indigenous in India; cultivated throughout the greater part of India (Duthie 1960)

Fruit Capsule (Fig. 3: h)
Two unidentified semi-carbonized fruit capsules measuring 4.00 x 2.50 to 5.00 x 4.00 mm in size have been recovered.

Fibers

Gossypium sp. (Fig. 2: m and o)
Carbonized seeds seem to be fairly large-sized, ovoid with thick seed coats measuring 5.00 to 6.00 mm in length, 2.50 to 3.00 mm in breadth and nearly 2.50 mm in thickness. In general appearance and on the basis of size the seeds are referred to the genus *Gossypium* of Malvaceae. The genus is divided into two sub groups – the wild and the cultivated. Seeds in wild species are comparatively small, longish and have thick seed-coats unlike the carbonized one. There are two species of diploid old world cotton in India, namely *Gossypium arboreum* Linn., and *G. herbaceum* Linn., seeds in both are more or less alike morphologically as well as anatomically. The carbonized seeds may safely be referred to any one of them.

Salmalia malabarica (DC) Schott & Endl. (Fig. 2: l and n)
The ob-ovoid seeds having smooth surface and measuring 4.00 to 5.00 mm in length, 2.50 to 3.50 mm in breadth and 2.25 to 3.00 mm in thickness, compare with those of *Salmalia* of family Bombacaceae. The only species *Salmalia malabarica* (Silk-cotton tree) of economic importance is found in this region, so it has been referred to this species.

Weeds and Wild Taxa

Andropogon L. (Blue-stem grass) (Fig. 3: s)
Semi carbonized elongated grains with one end rounded and the other tapering, measure 1.50 to 2.25 mm in length and 0.50 to 0.75 mm in breadth. Conspicuous hilum can be seen on the beak like projection of more or less evenly rounded dorsal side. The grains resemble closely with those of *Andropogon,* a robust annual as well as perennial grass species in the region.

Dactyloctenium aegyptium (L.) P. Beauv. (Crow-foot grass) (Fig. 3: n)
Semi carbonized ovoid caryopses with rugose surface and measuring about 0.75 to 1.00 mm in length and breadth were encountered. The hilum is located on the extreme apex of the grain. They compare closely with those of locally occurring *Dactyloctenium aegyptium* (L.) P. Beauv., a prostrate running and deeply rooted grass in sandy places, and as a weed in the crops of rainy season.

Echinochloa crusgalli (L.) P. Beauv. (Sawan) (Fig. 3: k)
The ovoid-orbicular grains having smooth surface and well marked hilum scar, measure around 1.00 to 1.50 mm in length, 0.75 to 1.00 mm in breadth and nearly 0.50 mm in thickness. They compare with those of *Echinochloa crusgalli* (L.) P. Beauv., a grass commonly growing in the water-logged situations and as a weed in the paddy fields also. *E. colonum* (L.) Link, which is cultivated as a minor crop has comparatively larger seeds.

Panicum sp. L. (Panicum grass) (Fig. 3: v)
Semi-carbonized broadly elliptical grains measuring 1.50 to 2.00 mm in length, 1.00 to 1.25 mm in breadth and about 0.50 to 0.75 mm in thickness, resemble with those of *Panicum* species in general morphology. Specific identification could not be made.

Setaria cf. *glauca* (L.) P. Beauv. (Foxtail grass) (Fig. 3: r and u)
Many semi-carbonised grains ovoid to somewhat oblong with narrow upper end, dorsal side curved; hilum conspicuously broad and occasionally covered up to half length of the grains. The grains measuring 1.50 to 2.25 mm in length and 1.00 to 1.50 mm in breadth are comparable to those of *Setaria* cf. *glauca.*

Indigofera hirsuta L. (Hairy Indigo) (Fig. 3: i and m)
Several semi carbonized seeds shaped like miniature satches with the minute hilum, measuring 1.00 to 1.50 mm. in length and 1.00 to 1.25 mm. in breadth, have been recovered. Seeds are comparable to those of *Indigofera hirsuta* L. of family Fabaceae; which grows in waste ground and as weed also in wheat and barley fields.

Vicia sativa L. (Common-vetch) (Fig. 3: q)
A few seeds, more or less globular to cubical, were recovered, measuring 2.00 to 2.50 mm in diameter. The carbonized seeds with small, ovate hilum raised along the median grove, are comparable to those of *V. sativa.*

Trianthema portulacastrum L. (Lalsabuni) (Fig. 3: j and p)
A few carbonized and semi carbonized seeds are compressed and orbicular in shape, characteristically beaked near hilum and exhibit transversally tuberculated surface. They measure 1.00 to 1.50 mm in diameter 0.50 mm in thickness. On morphological

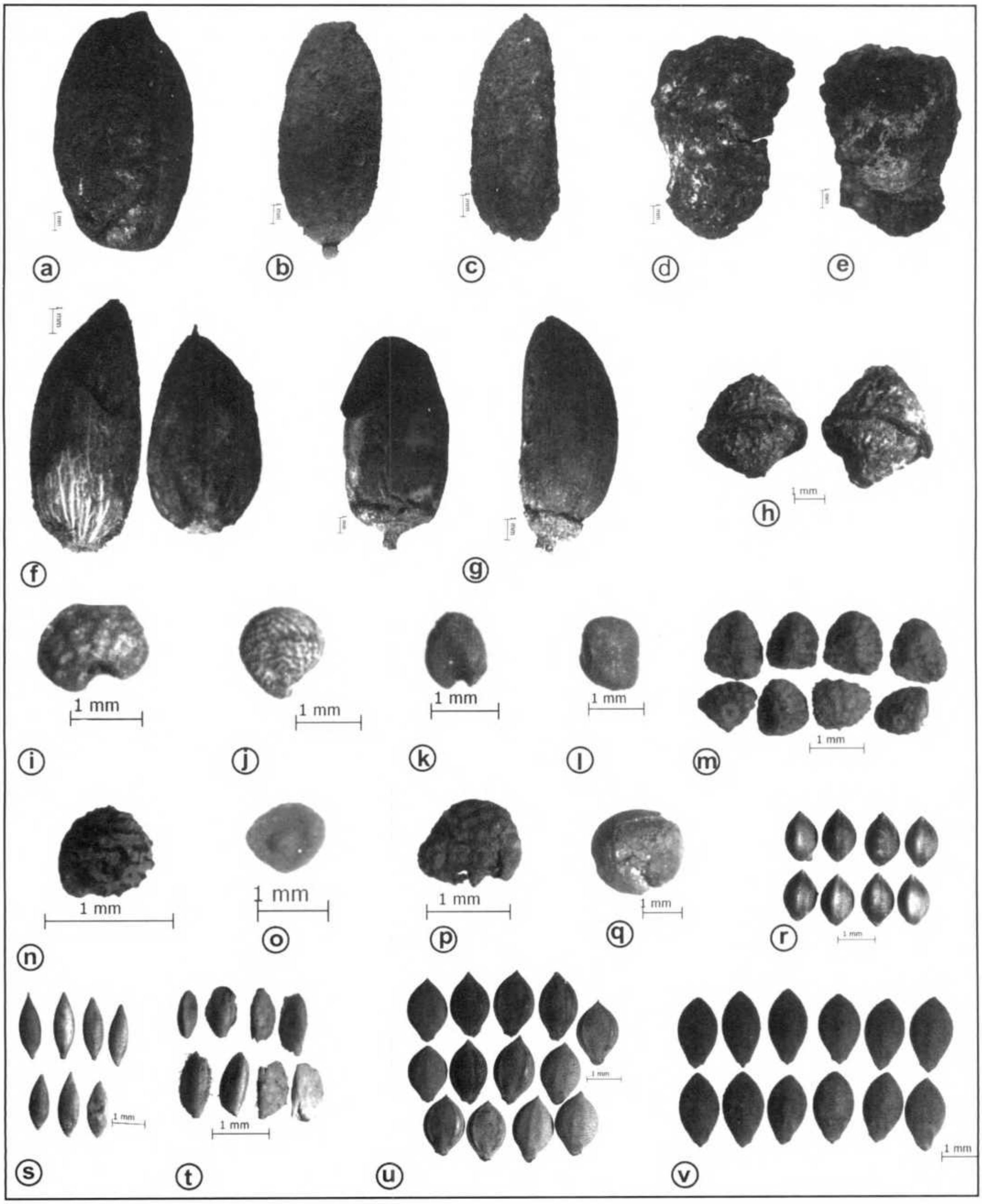

Fig. 3: a-b. Neem fruits, c. Neem seed, d-e. Cultivated jujube fruit-stone piece (outer & inner view), f. Extant neem seeds, g. Extant neem fruits, h. Unidentified fruit capsules, j. Hairy Indigo seed, j. Lalsabuni seed, k. Sawan grain, I. wild legume seed, m. Hairy Indigo seeds*, n. Crow-foot grass grain*, o. Fruit tip, p. Lalsabuni seed*, q. Common-vetch seed, r & u. Setaria species graoms*, s. Blue-stem grass grains*, t. Wild grass grains, v. Panicum grass grains*. *Semi-carbonised seeds/grains

grounds, these compare with the seeds of *Trianthema portulacastrum* L. (family Aizoaceae), a plant found on sand, the mud fencing and water drains in fields under cultivation, during the rainy season.

Wild grass (Fig. 3: t)
A few semi carbonized seeds oblong, flattish to trogonous in shape, narrowing towards both the ends measure 1.00 to 1.25 mm in length, 0.50 to 0.75 mm in breadth have been identified as wild grasses.

Wild legume (Fig. 3: l)
A few small carbonized seeds squarrish in shape, measuring 1.00 to 1.50 mm in length and nearly 1.00 mm in breadth and 0.50 mm in thickness have been identified as wild legumes.

Discussion

The palaeo-ethnobotanical investigations of seed and fruit remains revealed an advanced agriculture based subsistence economy during the Kushana times (A.D. 100-300). The crop remains amply demonstrate the rich and varied agricultural economy at Naimisharanya. Naimisharanya lies in a rice-growing zone. There is ample evidence of cultivated rice as being the staple food grain of ancient protohistoric and Early Historic communities in North India (Saraswat *et al.* 1994).

Barley and wheat are the main cereals of West Asian origin. These were found together from the very beginning of village farming in West Asia. Barley usually appeared with remains of other primary crops of the region such as wheat, pea and lentil. Both six-row, hulled and naked barley types appeared in West Asia by 6000 B.C. (Helbaek 1966; Renfrew 1969, 1973 and Murray 1970). In the light of occurrence of barley from many sites in North India dating from the 2nd millennium B.C. to 1000 B.C. (Saraswat 1980 and Saraswat 1992), the cultivation of this crop at Naimisharanya is well understood. Wheat grains found at Naimisharanya belong to highly evolved form of hexaploid species, i.e. dwarf-wheat (*Triticum shaerococcum*). In ancient India cultivation of dwarf-wheat, a drought resistant species, was wide spread.

Out of four type of pulses recovered at Naimisharanya, green-gram (*Vigna radiata*) and black-gram (*Vigna mungo*) are of Indian origin. India together with the Central Asia is believed to be the home of green-gram (*Vigna radiata*) and black-gram (*Vigna mungo*). Lentil (*Lens culinaris*) ranks among the oldest grain legumes of the world. This crop is closely associated with the domestication of wheat and barley in West Asia. Field-pea (*Pisum arvense*) is grown most extensively in cool countries, though also having an important role at high altitude in tropics and as a winter crop in some hotter regions. This crop constitutes an important source of protein.

Apart from evidence for the cultivation of cereal and pulse crops, remains of some fruits (Jujube, Gular, Custard apple and Neem) are significant. Jujube fruits appear to have been eaten by ancient settlers during the Chalcolithic period in India. It has frequently been mentioned in medical texts and medieval literature. Gular fruits are edible and of common use in native medicine. Leaves are also used as fodder. Earlier finds of fruit remains are known from the single culture sight of Madanapur in Shahjahanpur, U.P. in upper Ganga Plain from the PGW levels around 1000 B.C. (Srivastava 2005).

The record of Neem (*Azadirachta indica*) seed/fruit remains, a medicinally valuable tree from Kushana levels (100-300 A.D.) at ancient Naimisharanya is significant for archaeology of the Ganga Plain. So far wood charcoal remains of Neem have been reported from ancient Khairadih, on the right bank of Ghagra in Ballia District of U.P. from the NBPW levels (Saraswat *et al.*1990). The neem tree is native to India, Myanmar, Bangladesh, Sri Lanka and Pakistan growing in tropical and semi-tropical regions. It is one of the very few shade-giving trees that thrive in the drought prone areas. Normally it thrives in areas with sub-arid to sub-humid conditions, with an annual rainfall between 400 and 1200 mm. It can grow in regions with an annual rainfall below 400 mm, but in such cases it depends largely on ground water levels. It flourishes at annual mean temperatures between 21-32 °C. It can tolerate high to very high temperatures and does not tolerate temperature below 4 °C. Neem can grow in many different types of soil, but it thrives best on well drained deep and sandy soils.

In India, the tree is known as the "Divine Tree". It is a major component in Ayurvedic medicine and is particularly prescribed for skin disease. All parts of the tree (seeds, leaves, flowers and bark) are of medicinal value. Neem is a source of environment-friendly bio-pesticides.

The seed remains of custard apple found at ancient Naimisharanya is also significant. The finds of custard apple seed from the cultural horizons datable from 200 B.C. to A.D. 100 and of the carbonized custard apple fruit coat from the Kushana period (A.D. 100-300) are reported from Sanghol in Punjab (Pokharia and Saraswat 1999, Saraswat *et al.* 2009). The LSC and AMS ^{14}C dating of the charcoal and seed sample from Neolithic Tokwa, Mirzapur District, in the Vindhyan Plateau region of north-central India have pushed back the existence of cuatard apple in India to about 1740 B.C. (Pokharia *et al.* 2009). On botanical grounds, the custard apple is native to South America and the West Indies and is supposed to have been introduced to India by the Portuguese during the 16th century A.D. Its appearance in the Bharhut and Sanchi sculptures in Madhya Pradesh and in the carvings dug up at Mathura in Uttar Pradesh (2nd -1st B.C.) was seriously contested by botanists. The finds of custard apple seeds encountered at the Neolithic site of Tokwa site support the identification of custard apple in ancient Indian sculptures. In addition to this, carbonized seeds from iron-using culture at Raja-Nal-ka-tila, Sonbhadra District, in the Vindhyan region of southeastern Uttar Pradesh, have been dated at BSIP to 740 BC: BS-1988 (Saraswat *et al.* 2009 and Pokharia *et al.* 2009) and also support the pre-Columbian existence of *A. squamosa* in India. The remains of custard apple found on Indian soil should favour diverse arguments of a group of specialists proposing Asian-American transoceanic contacts before the discovery of America by Columbus. This archaeobotanical evidence, suggests the possibility of pre-Columbian contact between Asian and American regions (Johannessen and Wang 1998).

The evidence of cotton (*Gossypium* sp.) in India goes back to Harappan times (2300-1750 B.C.) as suggested by Gulati and Turner (1928). It seems likely that from Indus valley, cotton spread eastwardly into the Ganga valley in the second millennium B.C. In the light of this discussion, presence of cotton seed remains at this ancient site becomes clearly understood. The seeds of Silk-cotton are also recovered from the same cultural level. *Salmalia malabarica* (DC) Schott. and Endl., a silk-cotton tree is of common occurrence in the sub-Himalayan region (Duthie 1960). Its seeds from ancient Charda in Bahraich district (Srivastava 2002) and wood charcoals from Sringaverapura in Allahabad district of U.P. have already been recorded dating back from 950-800 B.C. (Saraswat 1986). Therefore, occurrence of *Salmalia malabarica* in this region of Ganga plain is clearly justified.

The carbonized seeds on morphological grounds belonging to about eight species of weeds and wild taxa. Due to excessive carbonization in a few categories, only tentative identification could be made up to generic level. Weeds are naturally components of the native and naturalized flora. The remains of wild taxa were found mixed with the crop produce in archaeological samples. The evidence of their collection does not suggest seed gathering and may be taken as a reliable evidence of the state of crop fields. These remains may give enough indication of the agro-ecosystem and point out how the crops fit in this system. *Dactyloctenium aegyptium* and *Trianthema portulacastrum* may have been the weeds in summer group crops like rice (Musil 1963). *Echinochloa crusgallii* is also a weed in paddy fields. *Vicia sativa* represent the weed components in winter crops, viz. wheat and barley in the ancient agriculture at Naimisharanya. As in ancient remains of crops, weeds and other wild taxa, the effects of soil and climate are integrated; therefore, it may be surmised that the agro-ecosystem in this region has been more or less over the past 2000 years. In India, occurrence of wild taxa is known from many archaeological sites. Thus many weeds may have arrived here along with the diffusion of crops from different regions.

The weeds and wild plants have their role in the ecology and economic history of ancient settlements. A good number of grasses grown in abundance around settlements in fields and fallow lands. Thus their seeds may be expected to turn up in the collection even without human interference. The remains of wild plants are only a fraction of biological material. Therefore, reconstruction of the environment cannot be attempted on the basis of these exclusively; however, reconstruction of the vegetation only around the settlement, can be surmised. There appears to be the presence of open vegetation around the site in which grasses represented the important flora, along with other herbs and shrubs on dry soil.

Acknowledgements

The author is grateful to the Director, Birbal Sahni Institute of Palaeobotany, Lucknow for providing facilities to carry out the present investigations.

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K.A. Pawar, *et al*, *Man and Environment* XXXVI(2): 45-50 [2011].
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Painted Rock Shelters at Dharul, in the Upper Tapi Basin, Madhya Pradesh

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Abstract

Central India, with the exception of some parts of the Deccan Trap, is extremely rich in rock art. The river Tapi is one of the major rivers of this region with its many tributaries. The discovery of four painted rock shelters, in 2007, provided interesting evidences of rock art and its associated material culture. This work discusses the important finds, and compares them with previous discoveries.

Introduction

Much before their discovery in Europe, rock art sites, were reported as early as 1867-68 by A.C. Carllyle, in the Vindhyan Hills of Central India (Mathpal 1984: 12; Neumayer 1983: 1; Chandramauli 2002: 13). Since then, because of the painstaking work of many scholars, nearly 5000 painted rock shelters are known in the Indian subcontinent (Chandramauli 2002: 13). The main concentration of these painted rock shelters is in Central India, particularly in Madhya Pradesh (Pandey 1984: 214).

A survey, in the Upper Tapi Basin in the Satpura Hills, was carried out in 2010. The main objectives of this survey was to investigate the nature of rock art in the Tapi Basin, to compare the rock art of this area with that of Central and Western India, and, to study different tribal traditions in relation to rock art and its associated material culture.

The Upper Tapi Basin (21° 25'and 21° 45'N; 76° 2' and 78° 14'E) covers a total area of 11,742 km^2. The length along the Tapi is nearly 200 km, while the breadth varies from 40 to 60 km. The Satpura region is the northernmost part of Maharashtra and is situated on the border of Maharashtra and Madhya Pradesh, which is part of the Deccan Plateau. The maximum height of the Satpura mountain range is 350 m above sea level (Singh 1971). The Satpura mountain range rises gently from the Tapi to the central crest and parallel to it and again descends down to the south, gradually towards the Narmada. Most of the region comprises of rugged rocky hills and valleys, having sedimentary rocks consisting mainly of sandstone and limestone. Part of it is overlain with alluvium and igneous rocks of the Deccan Trapp, mainly basalt. The southern part comprises the plain Deccan plateau formed of igneous rocks overlain by fertile black cotton soil used mainly for farming and orange orchards (Deshpande 1998).

For a better perspective of the rock art of the region, given that a number of panels inside the rock shelters depict plants and animals, it is essential to understand the present flora and fauna of the region. A variety of plants have been found in the dense forests of the Upper Tapi Basin. They are Babul (*Acacia nilotica*), Bel (*Aegle marmelos*) , Salar (*Boswellia serrata*), Bans (*Dendrocalamus strictus*), Bahera (*Terminalia bellerica*), Jamun (*Syzgium cumini*), Mohwa (*Bassica latifolia*), Teak (*Tectona grandis*), Peepal (*Ficus religiosa*), Imli (*Tamarindus indiaca*), Charul (*Holopteica integrifolia*), Ber (*Zizybus jujube*), Palas (*Butea monosperma*), Khiar (*Acacia catechu*), Karanji (*Pongamia pinnata*), Umber (*Ficus glomerata*), Anjan (*Memecylon umbellatum*), etc.

The Satpura mountain range is also extremely rich in wildlife. Tiger (*Panthera tigris*), Panther (*Panthera pardus*), Wild boar (*Sus scrofa*), Indian Black Bear (*Melursus ursinus*), Blackbuck (*Antilope cervicapra*), Indian Gazelle or Chinkara (*Gazella gazella*), Sambhar (*Cervus unicolor*), Cheetal (*Axis axis*), wild Dog (*Cuon alpinus*), Nilgai or Blue Bull

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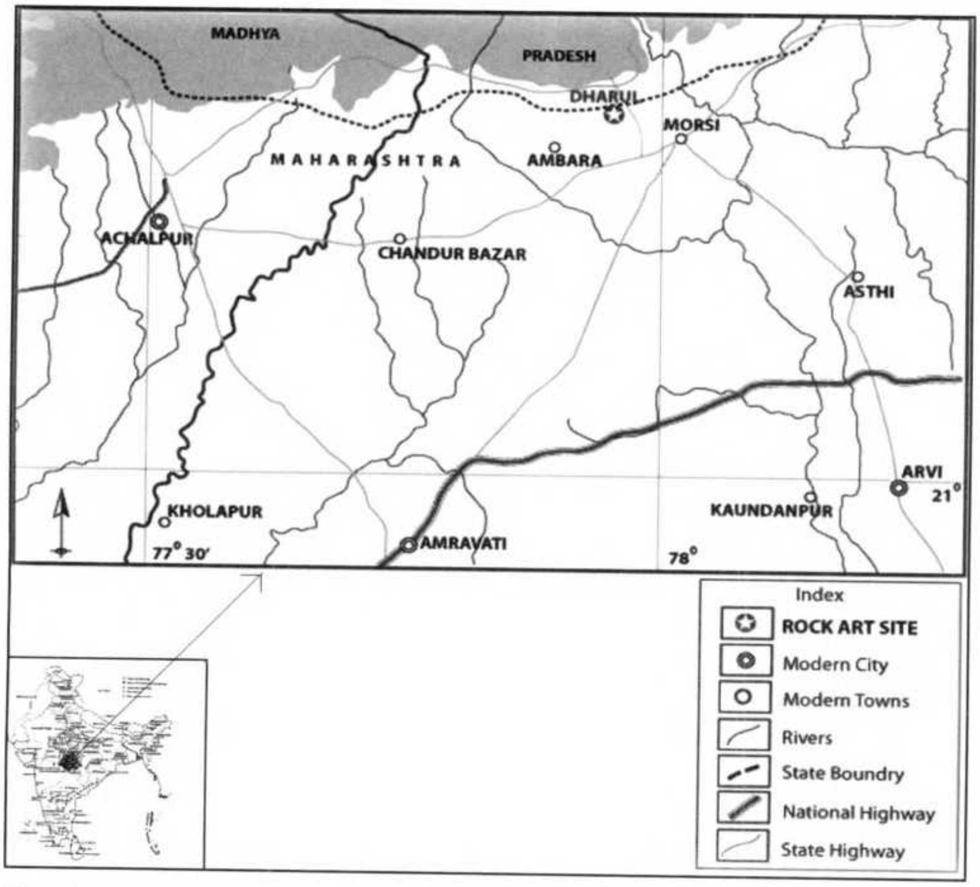
Received : 10-12-2010
Revised : 23-09-2011
Accepted : 30-09-2011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KHOLAPUR
77° 30'
AMRAVATI
78°
Index
ROCK ART SITE
Modern City
Modern Towns
Rivers
State Boundry
National Highway
State Highway

Fig. 1: Location map of the site

(*Boselaphus fragocamelus*) Squirrel (*Funumbulus palmarum*), Monkey (*Macaca radiata*), Langur (*Presbytis entellus*), Barasinga (*Cervus duvauceli*), Hare (*Cepus nigricollis*) , Hyaena (*Hyaena hyaena*), Wolf (*Canis lupus*), Jackal (*Canis qureus*), etc. are found here.

The rock shelters are located near Dharul (21° 23'15" N; 77° 56'15" E), taluka Atner, District Betul, Madhya Pradesh (Fig. 1). This village is predominantly occupied by the Gonds, whose livelihood is based on agriculture, cattle grazing, collection of honey, *Tendu-patta*, and the collection of timber from the forests and selling them in the market. The Satpura mountain range is just 1 km to the north of the village. Four painted rock shelters were discovered in 2007 by Dr. Vijay Ingole and his group of nature-lovers in the mountain range locally known as *Mugasadeo*.

Rock Art: Preliminary Observations

Recent explorations were conducted in a cluster named as *Kukkadshah*. The name is formed by two words – *Kukkad* and *Shah* indicating the name of a deity. According to the villagers, *Kukkad* means 'Cock' and *Shah* means a 'Lord'. In the past, the Gond kings who ruled the tribal regions held the title *Shah*, similar to *Maharajadhiraja*, which in time was accepted as a *lord* or *god*. The kings were known to worship a deity in a rock shelter annually. This particular rock shelter looks like the 'mouth of a cock' from the village (Fig. 2). On the way to

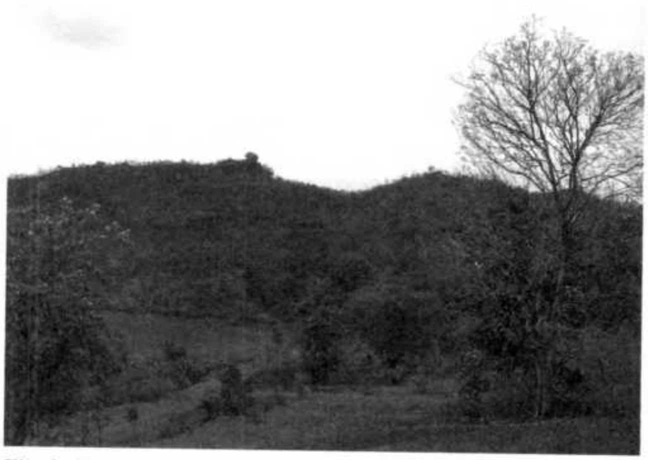

Fig. 2: General view of Kukkadshah

the rock shelters, there is a huge weathered lime deposit besides a small nullah and beautiful *Siva* image carved on limestone. The tribal people of Dharul village are known to worship this image on the occasion of *Mahasivaratri*. A big temple of *Ambadevi*, the village deity and protector of wildlife and all evil powers, is present at the foot of the hills.

The Satpura mountain range is about 200 m above the ground level, from the direction of Dharul village. During exploration, four new painted rock shelters were discovered, covered by huge sandstone and lime stone blocks and surrounded by a dense forest (Fig. 3).

Rock Shelter No. 1

Orientation of this rock shelter (24 x 6 m) is east-west. Its face was marked with thirteen engravings (Fig. 4). Of these 13 engravings, 11 depict the humped bull (Fig. 5, see cover 2). The other two engravings include a figure of a deer and a wild dog. Apart from the engravings, 13 paintings were also found on the surface and the ceiling of the rock shelter. Seven paintings were of animals, five of humans, and two were geometrical figures. One painting (*Godhani*) appears to be a modern painting. The animal figures, mostly depicted in dark red colour, include a deer, a barasingha, and, some unidentified figures, whereas, the human figures are bright red in colour. The engraved figures of the bull are deeply incised and vary in size. Although, the robustness of these bull figures suggest that they belong to a wild variety, it is difficult to prove only on the basis of the engravings. The geometric figures are depicted in a criss-cross pattern, using two painted lines, which intersect each other at a certain distance, making alternate, opposite triangles. The figure of *Godhani,* depicted in white colour, is on the lower part of the surface of the rock shelter. This has some ritualistic importance to the *Gond* community as, even in present times, the same symbol is depicted in their homes as well as in the rock shelters (Fig. 6).

Rock Shelter No. 2

This rock shelter is situated to the right of the Rock Shelter No. 1. It is circular in shape, (Fig. 7, see cover 2). Due to the heavy weathering from all sides, most of the paintings are not visible, only their traces are present. Among the animals drawn here, it is possible to identify a deer and turtle. Another striking feature of this rock shelter is the depiction of the *Godhani* which seems to be ancient. Most of the paintings here are drawn with the use of a dark red colour, but some of them are in a bright, but faint red colour.

Fig. 3: Discovered painted rock shelters

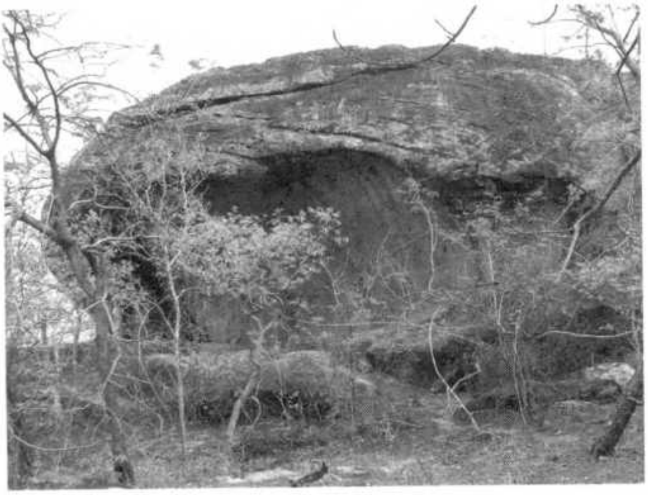

Fig. 4: View of painted Rock Shelter No. 1

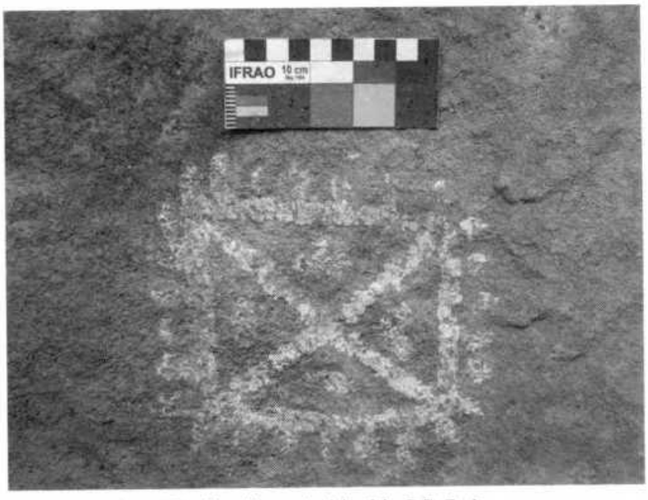

Fig. 6: Modern 'Godhani' symbol inside P.R.S. 1

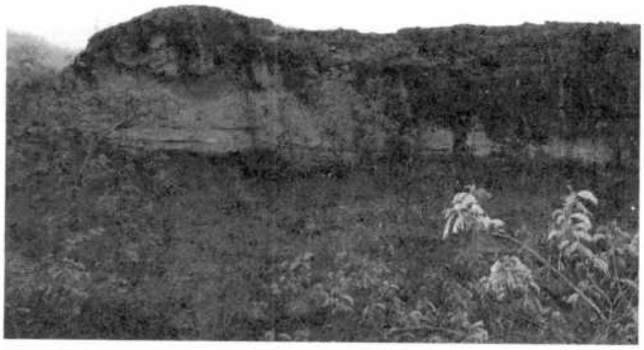

Fig. 8: View of painted Rock Shelter No. 3

Rock Shelter No. 3

This rock shelter (47 x 7 m) is formed within the long cylindrical shape boulder, facing south-western (Fig. 8). This rock shelter is not as weathered as the others. All of its large paintings are clearly visible. Among the paintings, the honeycomb, the turtle, the deer, and fish are depicted in a bright red colour (Fig. 9). All the paintings are drawn on the south-western surface except one concentric depiction of a deer that is in the lowermost part of the shelter.

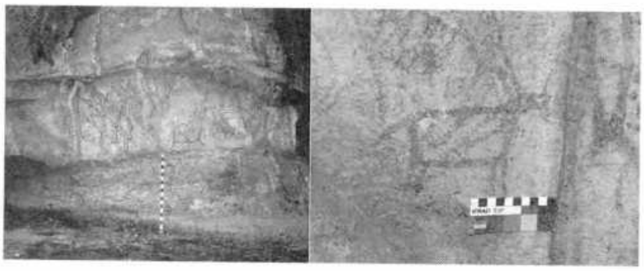

Fig. 9: Depiction of honey comb, deer, and, turtle

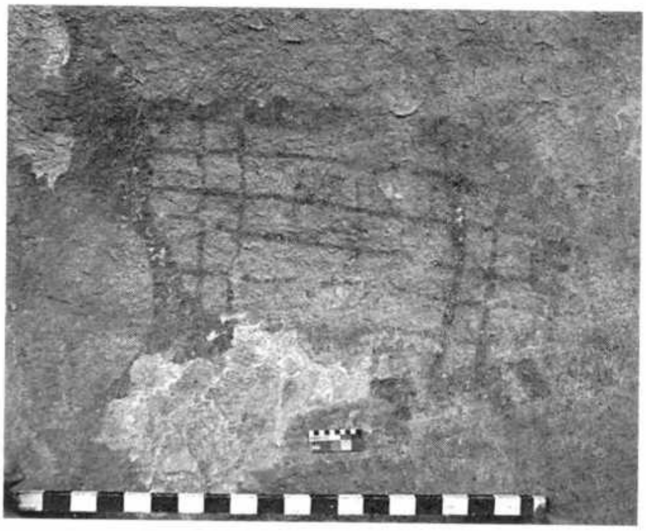

Fig. 11: Life-size depiction of wild boar

Rock Shelter No. 4

This rock shelter is just below Rock Shelter No. 3, facing north. Life size figures of deer, boar and pairs of fish are the significant features of this rock shelter (Fig. 10-11, see cover 2). Some small figures of deer, barasingha and criss-cross geometric designs, are also present. The life size figures are in a dark red colour, whereas the geometric figures are in a dull red colour.

Rock Shelter No. 5

This small rock shelter is just a few metres away in the western direction of the Rock Shelter No. 4, facing the east (Fig. 12). A few paintings have been drawn on the top surface of this rock shelter in bright red colour. In the centre, there is a human figure surrounded by animal figures (Fig. 13).

Microliths

In all the rock shelters of *Kukkadshah* microliths were found. These were made of siliceous material like agate, chalcedony, chert, jasper, quartz, etc. The most common types were blades, varying from 1 to 3 cm in length. The lunates, scrapers, points, borers

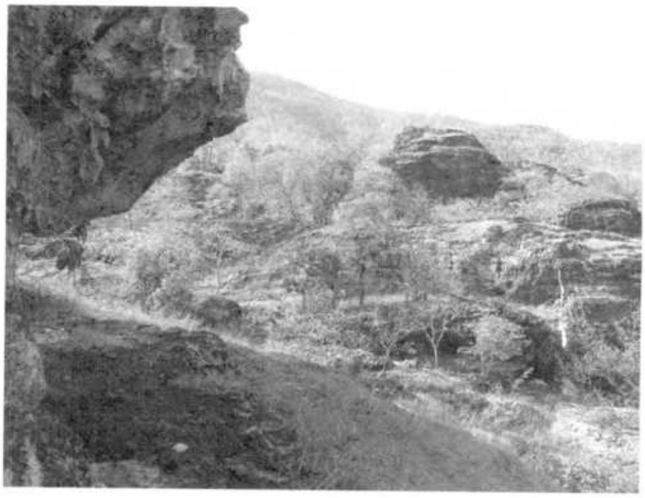

Fig. 12: East-facing painted Rock Shelter No. 5

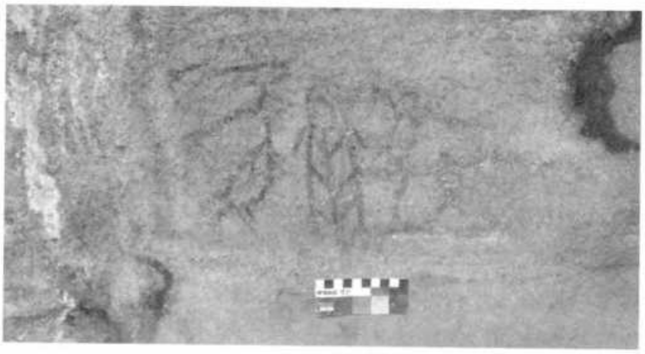

Fig. 13: Depiction of human and animal figures inside P.R.S. 5

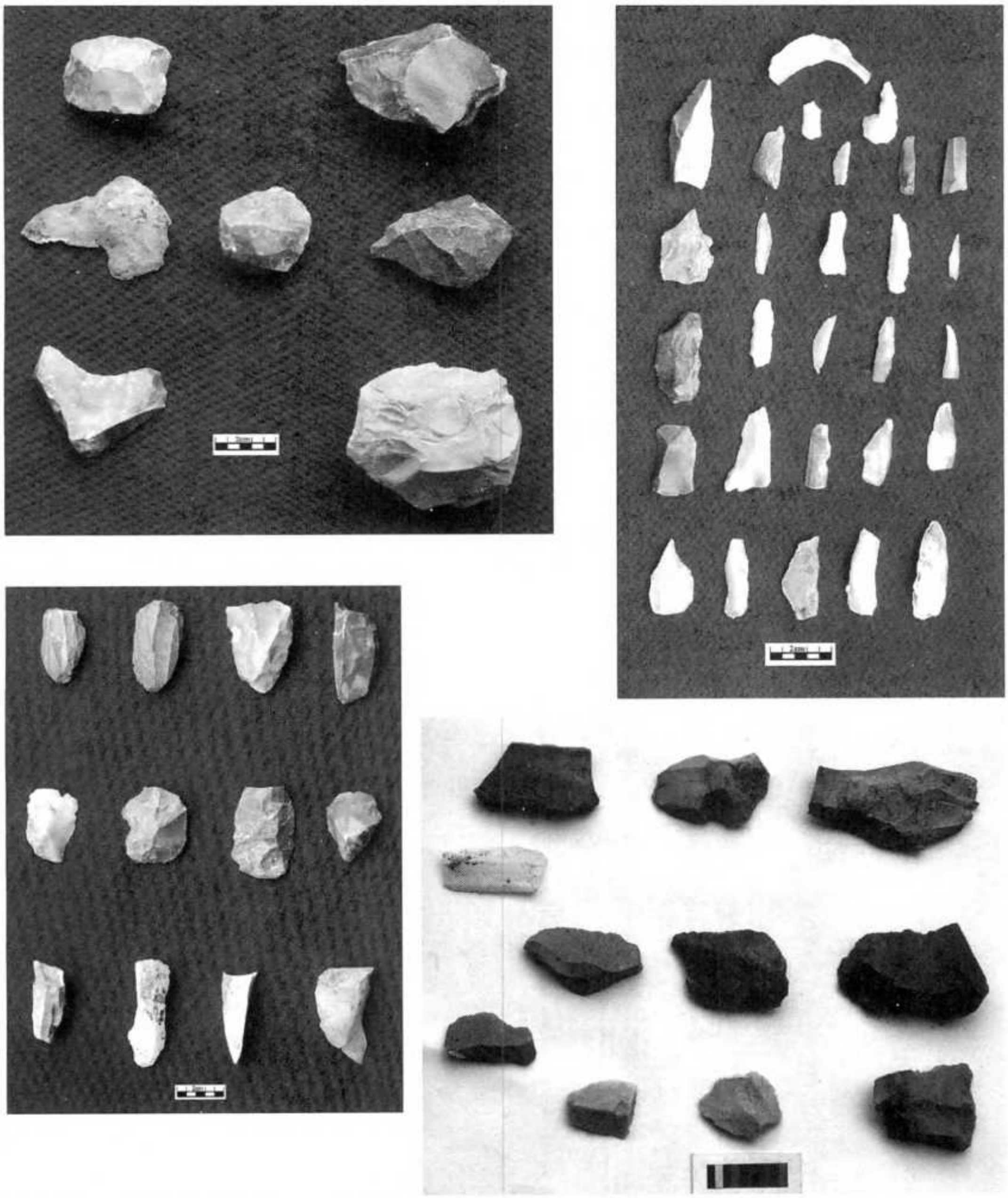

Fig. 14: Microlithic artefacts from rock shelters

and retouched blades are the other types found in the assemblage (Fig. 14).

Conclusion

The findings of the rock shelters at Dharul are significant in many ways. The rock paintings of these shelters provide evidence of the combination of the Vindhyan and the Deccan style of rock paintings, which have been documented in parts of Rajasthan and Madhya Pradesh by previous scholars. In addition to the richness and the density of rock art sites in the Upper Tapi Basin surveyed by previous researchers, this new and large concentration of painted rock shelters provides us with the potential to conduct further rock art research in this region.

Most of the paintings depict animals and lack any significant themes like hunting, grazing, running, etc. There are some minor superimpositions in Rock Shelter No. 3. The geometrical paintings are more in number in these rock shelters, as compared to the *Mugasadeo* rock shelters. These geometrical paintings are huge in size, For example, one depiction in Rock Shelter No. 1 is more than 1.5 m. Majority of the engravings are of bulls. The evidence of the

Godhani belonging to the ancient as well as modern period is significant, as it shows the continuity of the tradition of the rock art in the region.

The rock paintings at Dharul village are classified according to their art form as: (A) silhouette style, (B) half-filled drawings, (C) decorative drawings, (D) outline drawings, (E) spray paintings and, (F) geometric style. The depictions of animal figures painted in the dark red colour, life size, and, drawn with naturalistic outlines, can be dated to the Mesolithic period, on the basis of their style. The engravings inside the Rock Shelter No. 1 could belong to the late Mesolithic period, as most of the engravings are of humped bulls. On the basis of style and material evidence, the chronology of the Dharul rock paintings can be placed in the time-frame between the Mesolithic and the Historic period.

Acknowledgements

We are grateful and acknowledge Prof. V.H. Sonavane, Prof. V.S Shinde, Dr. Vijay Sathe, and, Dr. Ismail Kellelu, for providing us their time, valuable guidance and encouragement. We are also thankful to Mayabhau, the priest of Dharul village, and his family for the support and help. Without them, it would have been very difficult to discover such remote shelters. We cannot also forget the support given by Dr. Saleem, Nilesh Jadhav and Akshay Borkar.

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A S Gaur *et al., Man and Environment* XXXVI(2): 51-57 [2011]
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Excavations at Kanjetar and Kaj on the Saurashtra Coast, Gujarat

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Abstract

Onshore excavations were undertaken at Kanjetar and Kaj around Kodinar in Gujarat. Kanjetar is located about 12 km southwest of Kodinar on the coastal region. This is a single culture site of the Harappan phase. The entire area is a known agricultural land and the maximum habitation deposit is about 60 cm from the surface. The pottery is typical of Saurashtra Harappan type. Kaj is located about 10 km east of Kodinar on the bank of Modhwada Creek. The site is situated about 2 km east from the village Kaj and presently it is called *Juna* Kaj. This site has a three-fold cultural sequence where the oldest habitation belongs to the Harappans, followed by the historical and later medieval period respectively. The location of the site indicates that the creek could have been used as a sheltered harbour. Interestingly, Roman amphorae were collected during onshore explorations from the site of Kaj. This article discusses the findings of the onshore excavations that were undertaken at these two sites.

Introduction

Since the excavation of Lothal (Rao 1979) in the early sixties, followed by intensive explorations on the Indian side, a number of sites affiliated with the Harappan civilization have been found. The study of the Harappan civilization has dominated Indian archaeological research for over a half a century. A few major excavations of Harappan sites, such as Rangpur (Rao 1962-63), Rojdi (Possehl and Raval 1989), Nageshwar (Hegde *et al.* 1990), Surkotada (Joshi 1990), Kuntasi (Dhavalikar *et al.* 1996), Dholavira (Bisht 1997), Padri (Shinde 1992), and Bagsra (Sonawane *et al.* 2003) in Kachchh and Saurashtra region have since enhanced our understanding of of Harappan settlements, their town planning, utilization of various resources, and, specialized crafts. Archaeological investigations around Kodinar region of Junagadh district (Fig. 1) have revealed interesting finds.

Previous work

The site has been referred to as a coastal Harappan site in earlier literature associated with Harappan archaeology. A report of minor significance was published by Rao (1962-63) on the excavation of Kanjetar. This report discussed Harappan ceramics and their shapes, but makes no mention about the structural activities. Ratnagar (2004) suggested it to be a halting station of the Harappan mariners on the mid-Saurashtra Coast.

An onshore exploration in Kanjetar during 2008-09 revealed the presence of two mounds; Mound One is situated about 500 m east of the village, the other, second mound, is situated about 2 km west of the village of Kanjetar, and about 1 km east of the port village of Dhamlej . Mound One I was identified as the habitation of the historical period where a rock-cut well was noticed (Gaur *et al.* 2009). The second mound was primarily identified as a protohistoric mound and the entire area at present is under cultivation.

The other site at Kaj has been mentioned as a late Harappan site in the list of Harappan sites of Gujarat (*IAR* 1957-58:19), but no further work was undertaken in this area. Onshore exploration (2008-09) at Kaj yielded a large number of protohistoric pottery fragments besides a large amphora and a stone anchor (Gaur *et al.* 2009).

Kanjetar

The site of Kanjetar is situated about 12 km southwest of Kodinar. The distance from the coast is less than a kilometre. A dry creek is noticeable on

Received : 05-05-2011
Revised : 30-07-2011
Accepted : 30-08-2011

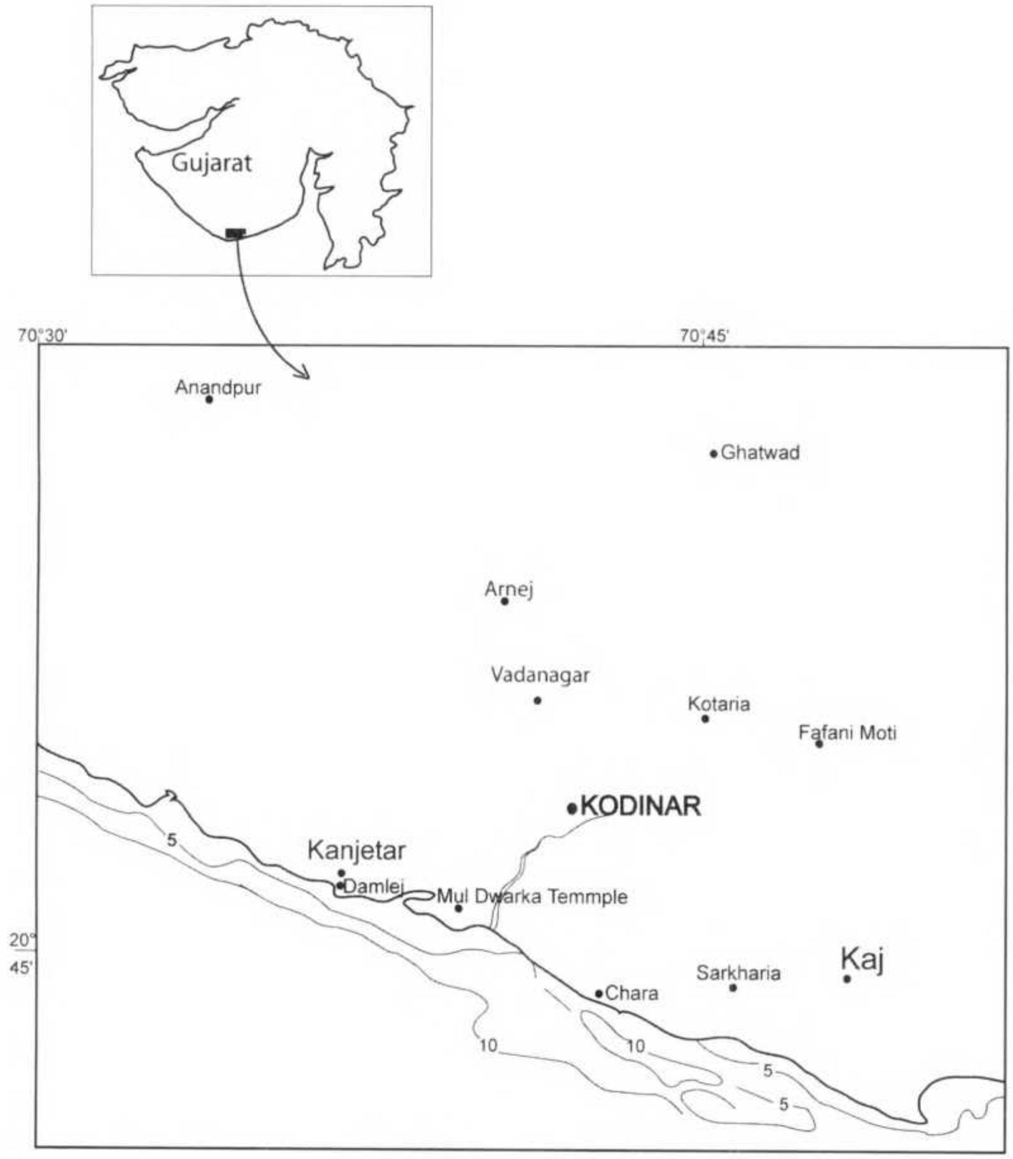
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Fig. 1: Archaeological sites around Kodinar

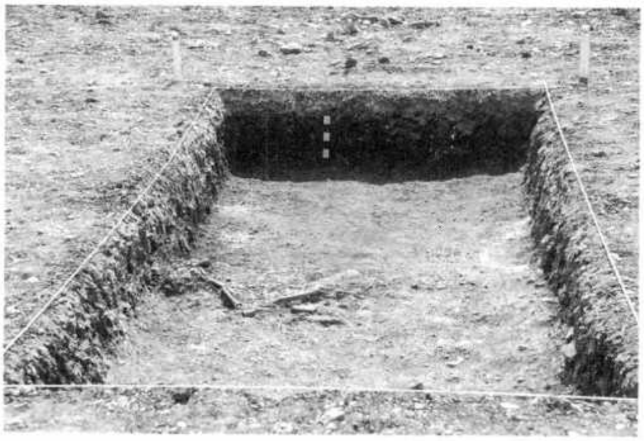

Fig. 2: Excavated trench at Kanjetar

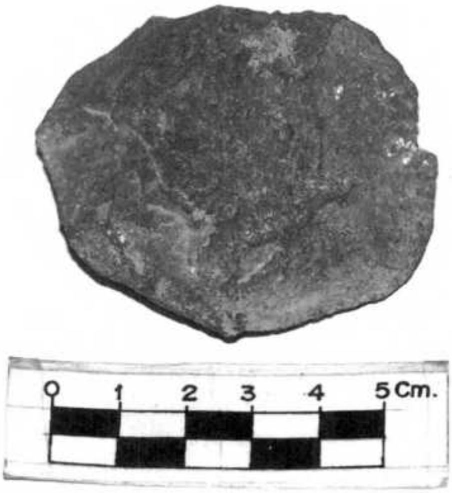

Fig. 3: Scraper in red jasper from Kanjetar

the eastern side of the village Kanjetar where another historical period site was observed. The entire site has been converted into an agriculture land, thus most of the habitation area has been destroyed.

A trench measuring 2.5 x 5 m was laid on the southern most point of the site (which is under cultivation) to understand if any associated maritime activity can be traced. The archaeological deposit could be found up to 50 cm depth followed by a hard *kankar* layer (natural deposit). Two habitation layers were observed during the excavation – Layer 1 of loose soil (light brown in colour) with occasional gravel mix, and Layer 2 is of compact soil (dark brown colour) with more gravel mix (Fig. 2). The major findings include various types of Harappan pottery. Due to the limited excavation area no regular structural remains could be traced, and a large number of scattered stones were found during the excavation. However, while in discussion with the local farmers, it was learnt that a lot of stone structures had been destroyed while converting the site into agriculture land and were placed as the boundary walls of the fields.

The most interesting find from the trench was the skeletal remains of a child lying just over the natural bed. Present were the skull, bones of each leg, and a hand bone. There was no indication of any graveyard or cemetery. There were many animal skeletal remains, and a columella of *Turbinella pyrum*.

Stone tools

During the surface explorations two stone tools, ,one of jasper and chert, and an unfinished tool of quartz (2.3 x 2.1 cm) were found. The flake tool (3 x 2.1 cm) made of red jasper had sharp edges (Fig. 3). The other tool was almost like a triangular scraper (3.4 x 2.8 cm) made of banded agate that had blunt edges and a positive bulb of percussion.

Pottery

The ceramics included sturdy Red ware similar to the mature Harappan pottery (Rao 1985), and varieties of bowls of fine ware similar to that of the Sorath Harappan type (Possehl and Raval 1989: 57). The important shapes include jars, bowls, dish-on-stand, and, a goblet. In addition, a few painted sherds were recovered – painted with black, dark brown or chocolate colour over red, orange, dull red or white surface (Fig. 4). A brief description of some of the pottery is given below.

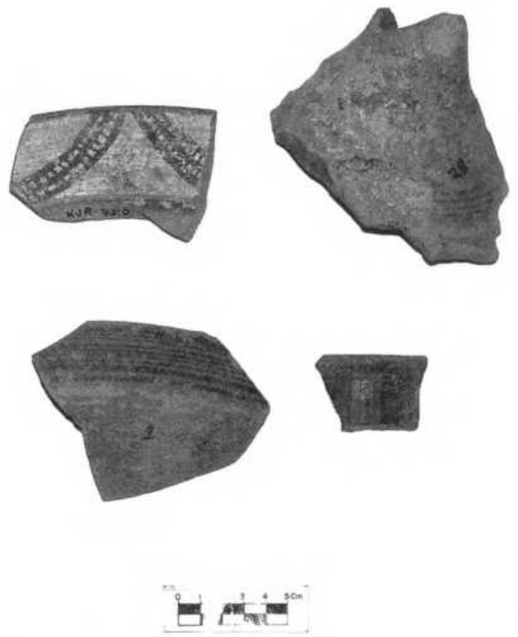

Fig. 4: Pottery from Kanjetar

Faunal Remains

A total of 44 fragments of animal skeletal material were recovered from the excavation, of which 30 were identifiable (Fig. 5). The fragments exhibited moderate breakage, and few showed minor soil encrustations. Fresh breakages, probably due to the recovery process or transportation, were noticed in a few cases. Freshly broken fragments of a single bone were considered and numbered together as a single piece.

All animals identified from KJR-2010 belonged to the domestic variety, which include cattle, buffalo, sheep/goat, and a bird (chicken) (Table 1). Skeletal elements of not a single wild animal were /found. Interestingly, two human bones (potion of right and

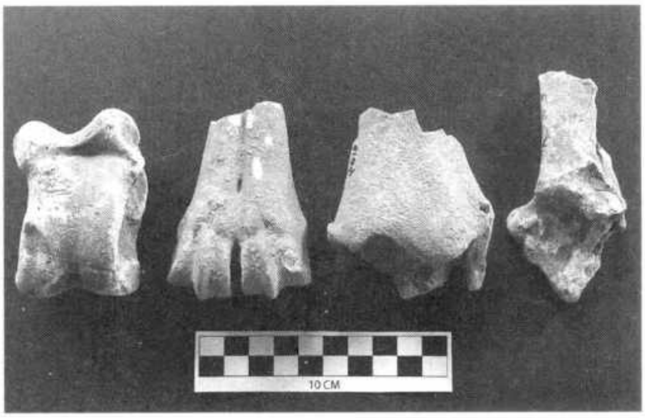

Fig. 5: Kanjetar: Bones of cattle

Table 1: Animal taxa identified at Kaj and Kanjetar

Species	Kanjetar	Kaj
Bos indicus	11	18
Bos/Bubalus	14	38
Bubalus bubalis	1	6
Boselaphus tragocamelus	0	1
Capra hircus/Ovis aries	1	6
Antilope cervicapra	0	4
Canis familiaris	0	1
Canis sp.	0	1
Felis catus	0	6
Equus sp.	0	1
Gallus domesticus	1	0
Scylla serrata	0	1
Total	28	83

left radius bones of a single adult) were recovered, but were found in six fragments (Fig. 6). These fragments may have gotten transported into the settlement due to action of post-depositional factors. The faunal assemblage has a bone tool (point) probably made by splitting the bone shaft of the long bone of cattle (Fig. 7).

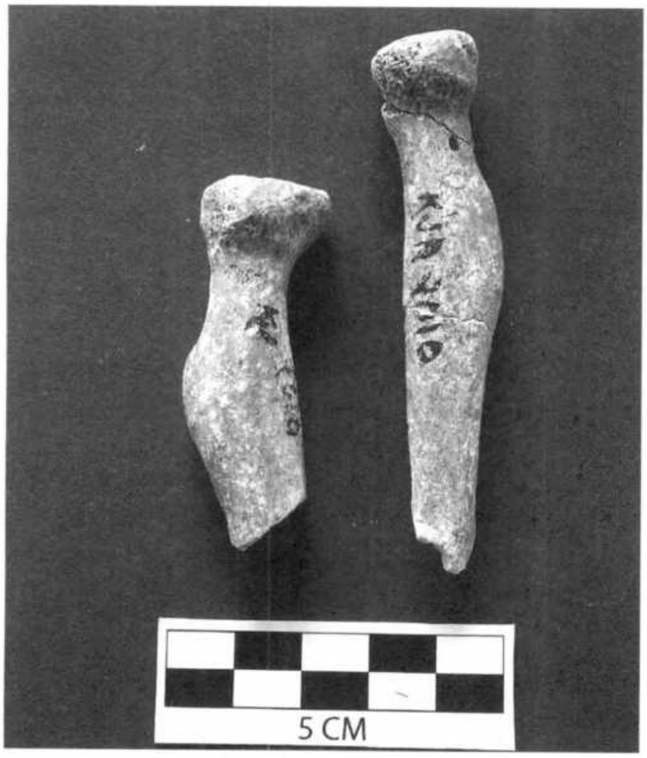

Fig. 6: Human bones recovered from Kanjetar

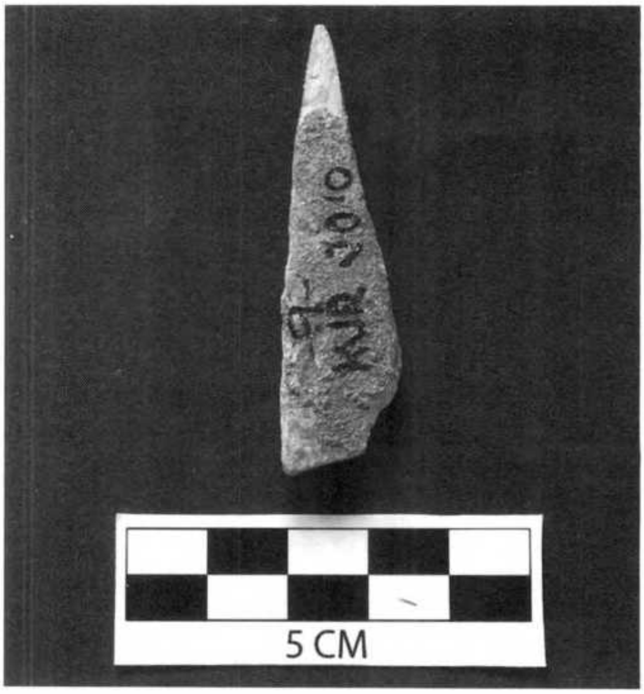

Fig. 7: Kanjetar: bone point

Kaj

The village of Kaj is situated about 10 km east of Kodinar town on the Dwarka- Bhavnagar highway. The ancient mound, locally called as *Juna Kaj*, is situated farther 2-3 km east of the present village. On the eastern side there is a large freshwater body that serves as a bird sanctuary where Siberian birds are known to visit annually. The site (approximately 4 ha) is located very close to the creek and has been converted into agriculture land. Only an area of 100 x 100 m has remained undisturbed. However, proximity to the sea suggests that the site was probably located on the western bank of the creek, and during high tide the sea water could have reached up to Kaj and farther on the northern side.

A trench measuring 2.5 x 5 m was laid in the undisturbed portion on the eastern corner of the site. Archaeological remains were traced up to 1.5 m depth and four different layers were identified (Fig. 8). Upper 1 m deposit belongs to the Medieval period and remaining 50 cm was associated with the protohistoric period. Though a few historical period artefacts were collected from the surface, no trace of such artefacts was found during the excavation. Perhaps the

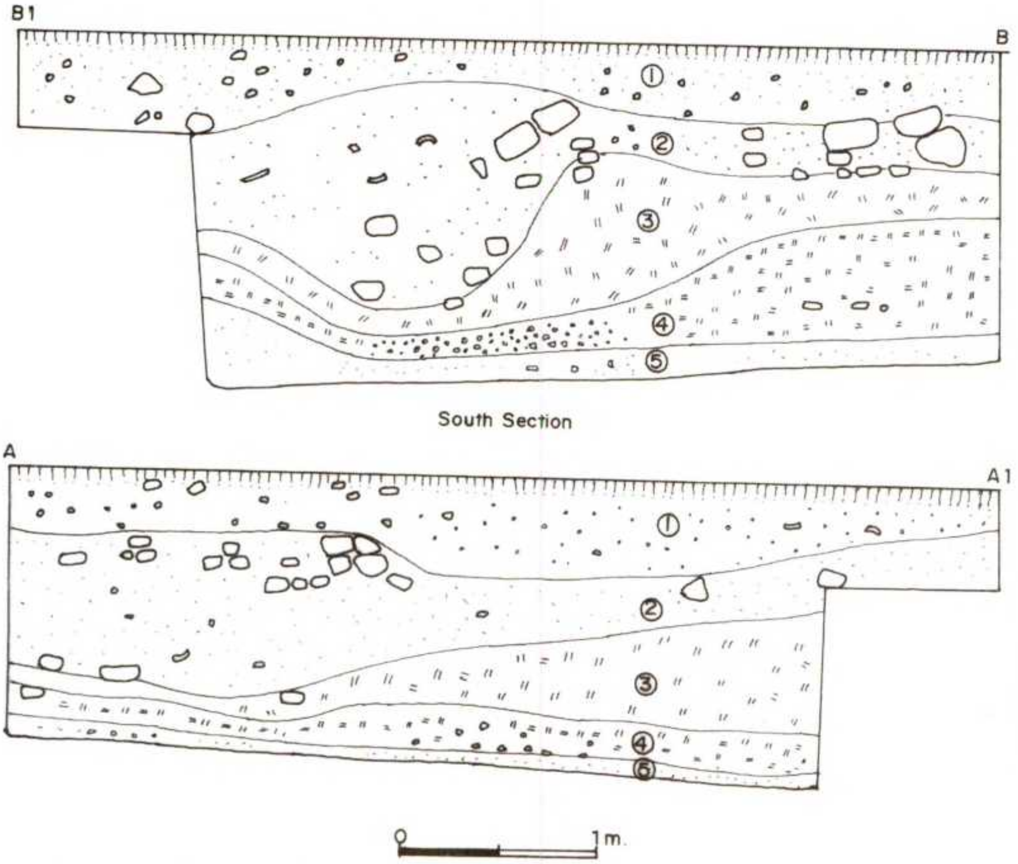

Fig. 8: Section of a trench at Kaj

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early historic period site was located on the northwestern part of the present excavated site. A large quantity of the Medieval period pottery, primarily Black ware was collected during the excavation including a couple of Medieval glazed ware sherds. The important shapes are jars, cooking vessels and lids. Though many Medieval copper coins (Fig. 9) had been collected by local residents from the site, none were recovered from the stratified contexts.

The archaeological deposit of the protohistoric period is limited to 50 cm in this trench. The pottery comprised of typical Harappan types. Important shapes include bowls, carinated dishes and dishes-on-stand (Fig. 10). Many potsherds were painted with various colours such as black over red, white over red and purple over red. The pattern of paintings includes wavy lines, dotted circles and crossed lines.

Interestingly, in one of the agriculture fields, a handle of amphora was collected, and later a large part of the amphora which was being used as water storage for hand washing in the field was observed. The discovery of such artefacts suggests that Kaj was a Harappan port town and later participated in the Indo-Roman trade activities on the Saurashtra coast.

Faunal Remains

The faunal material, from KAJ-2010, includes both domestic and wild animals (Table 1). Except one crab (*Scylla serrata*) (Fig. 11), all other skeletal elements

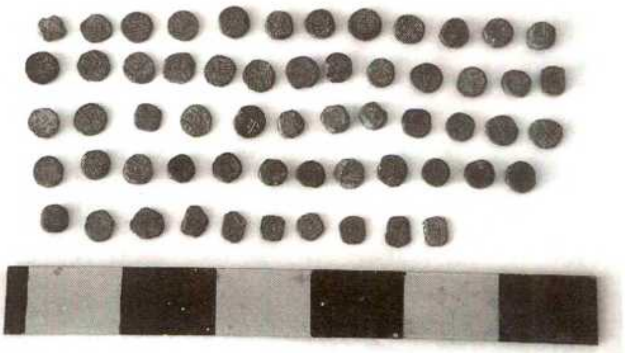

Fig. 9: Medieval period coins collected by local people from Kaj

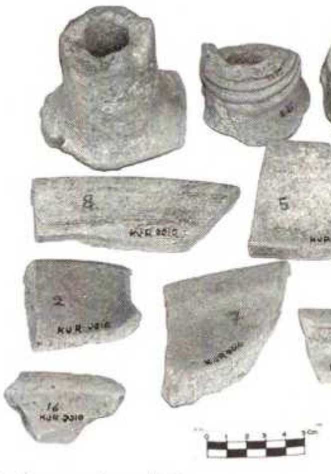

Fig. 10: Pottery from Kaj

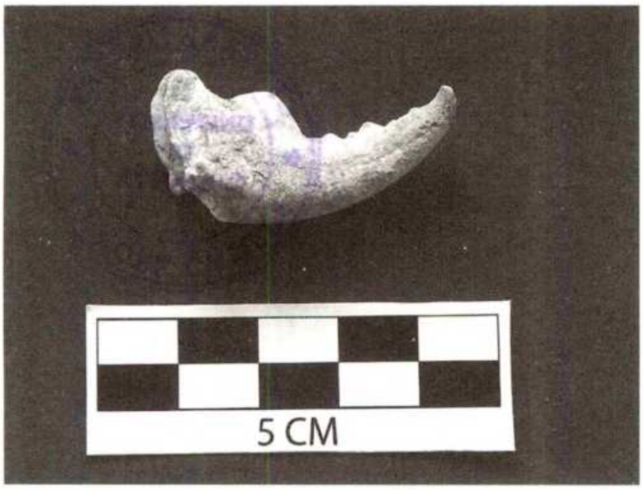

Fig. 11: Kaj: crab finger

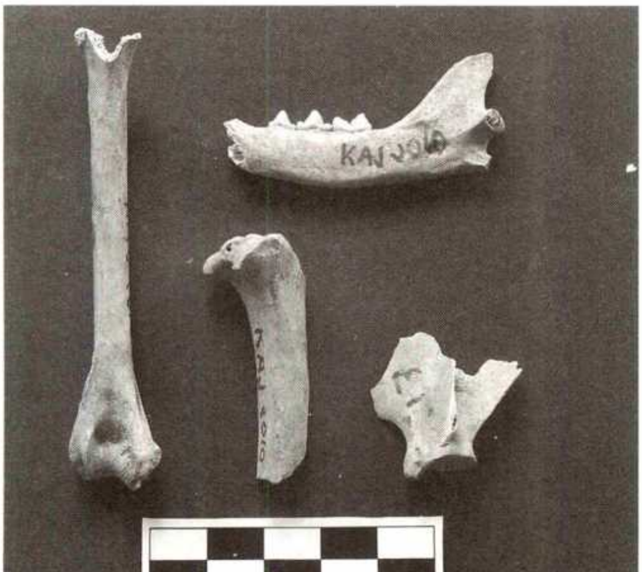

Fig. 12: Kaj: Bones of domestic cat

belong to mammals. The domestic mammals consist of cattle, buffalo, sheep/goat, dog, and, cat. The wild mammals identified were the nilgai and blackbuck. Interestingly one bone could be identified with that of Genus *Equus*; but the species could not be definitely identified. Six fragments of the domestic cat were recovered that belonged to a single animal (Fig. 12). There were no cut marks on all these fragments, but all were broken earlier, perhaps after their deposition. Presence of cattle of old age was evident from the worn out pattern of the teeth. The faunal assemblage like that of Kanjetar has a bone tool (serrated point) made using cattle long bone shaft (Fig. 13).

Discussion and Conclusions

The Saurashtra coast has a number of small-sized Harappan sites that may have played an important role in developing Urban Centres such as Lothal and Rojdi in the Saurashtra region. The area is rich with fertile agricultural land along this coastal belt, and is punctuated with creeks that could have facilitated sheltered harbours for maritime activities. However, Kanjetar is a very small Harappan site. Except for pottery, none of the Harappan elements such as seals, weights, terracotta cakes, beads, etc. were found. This could indicate that Kanjetar was not an

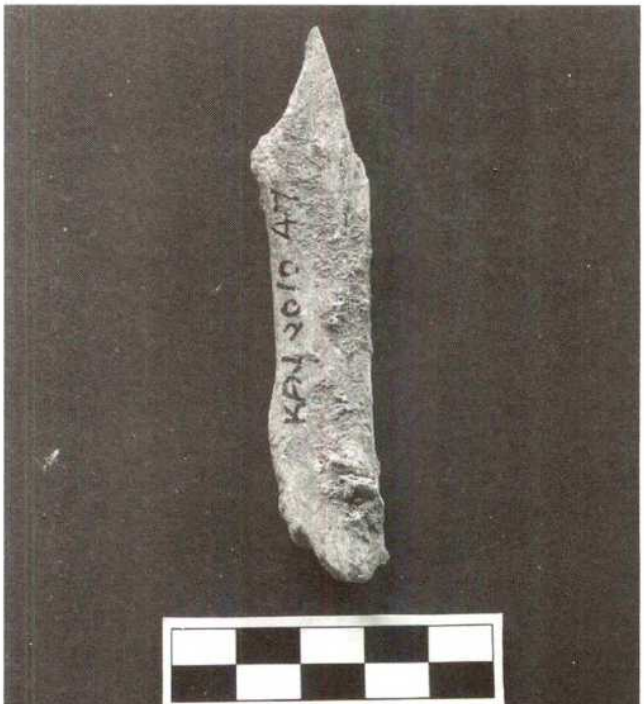

Fig. 13: Kaj: Serrated bone point

urban centre, and therefore may be categorized as a village settlement. The role of the site in overseas trade is not securely identifiable. The pottery from Kanjetar closely resembles with that of the Prabhas ware. The type site Prabhas is situated about 40 km west of Kodinar, a Chalcolithic site contemporary to the Harappan sites (Sankalia 1974: 381). The frequency of painted sherds is more than that found at Bet Dwarka (Gaur *et al.* 2005) and Bokhira (Gaur *et al.* 2006). Similarly, Kaj which appears to have been initially inhabited during the Harappan times, and, later during the historical and medieval periods, is very interesting located. As mentioned earlier, the location of site favours it as a safe harbour. The archaeological evidence indicates that the site may have served as a trading post on the mid-Saurashtra coast during the historical and medieval periods as evidenced from the discovery of amphorae and stone anchors discovered there. The pottery of the protohistoric period is very similar to that reported from Kanjetar. On the basis of comparative ceramic study the time bracket for the protohistoric settlement at Kanjetar and Kaj may be between late 3rd and the early 2nd millennium B.C.

Acknowledgements

Authors are thankful to Shri. K.H. Vora, for helping facilitate the study, and also, suggesting improvments in the manuscript. We thank Shri Bharatbhai and Shri. Laxman Sosa of Kodinar, and, Shri Bhavesh of Dhamlej, for facilitating the excavation at Kanjetar and Kaj. This is NIO Contribution No. 5123.

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Narender Parmar, *Man and Environment* XXXVI(2): 58-65 [2011].
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Archaeological Investigations in Southern Haryana

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Abstract

The present paper deals with results obtained from recently conducted archaeological investigations (village to village survey) in Southern Haryana. The alluvial plains of palaeochannels of ancient Saraswati-Drasdwati show extensive relics of archaeological settlements. Nevertheless, as one moves away from the fertile region and enters the dry area of sand dunes and Aravalli outcrops, alluvial plains become sparse especially in Southern Haryana. This study hopes to throw light on the cultural process, settlement system and nature of sites between the Indo-Gangetic Plain and the Thar Desert. The main focus of this paper is to highlight the archaeological potential of this semi-arid zone.

Introduction

It is believed that the Sarasvati-Drasdwati Valley, being fertile and well watered, was thickly populated from the Early Harappan times, the beginnings of which have now been stretched back to the early 4th millennium B.C. The part of the Sarasvati Basin extending into the Bahawalpur District in Pakistan, termed as Hakra, had been systematically surveyed by Mughal (1997). He had discovered more than 450 sites. Similar efforts have been found lacking on the Indian side, though many scholars have carried out extensive and intensive surveys, but in patches. This paper presents the discovery of several sites, in addition to the known rich cultural repertoire in Southern Haryana, based on systematic surveys. The main aim of this exploration was to collect first hand data about the sites located in this region. The secondary aim was to gather in-depth knowledge of the cultural sequence in this region. The material inventory (pottery and other associated finds of different cultures) collected from sites during the exploration has been systematically and scientifically examined.

Study Area (28° 52' to 29° 03' N; 75° 52' to 76° 07' E)
The present investigation was carried out in Bawani Khera block, which is one of the nine blocks of Bhiwani district, Southern Haryana. It is situated 19 km northeast of Bhiwani on the Bhiwani- Hansi road. It includes 32 villages. Although, the present habitation of Bawani Khera is on the medieval mound, archaeological evidence indicates that it belongs to the Kushana-Gupta period (Haryana District Gazetteers, Bhiwani 1982: 563). Tradition has it that several hundred years ago Mahant Balinath founded a *Dera* in the town and people believe that it existed even before the present town was inhabited. At present there is a Shiva temple inside the *Dera* of Nath.

The region occupies an intermediary place between the Indo-Gangetic Plain and the Thar Desert of Rajasthan. It is generally a flat area having a north-east to south-west inclination. The topography is marked by the termination of tributaries of the western Yamuna canal system. The flat area is well known for cultivation. Some parts of this region have sand dunes with varying shapes and sizes. The predominance of hills and sand-dunes west of this region reverse the inclination of the land characteristic of the canal irrigated area. In between the sand dunes there are fairly levelled surfaces which constitute the main agricultural land. Throughout this belt the altitude ranges between 203 to 212 m AMSL. However, there is a stray occurrence of sand-dunes near villages Baliyali and Badesra in Bawani Khera block. The direction of the sand dunes is inconsistent, and the dunes which are quite closely spaced, represent an extension of the Thar Desert (Haryana District Gazetteers, Bhiwani 1982: 10).

Received : 22-12-2010
Revised : 03-06-2011
Accepted : 23-08-2011

Results and Discussion

The exploration brought to light fifty six sites (Fig. 1, Table 1), belonging to different cultural traditions, which range from the Early Harappan to the Medieval period. On the basis of nature of surface collections the sites can be divided as: Early Harappan (11), Mature Harappan (5), Late Harappan (13), Painted Grey Ware (5), Historic (11) and Medieval (36).

Earlier research (Silak Ram 1972; *IAR* 1987-88: 20-21) have highlighted the archaeological significance of the region and clearly established that the Harappans were the first people to inhabit this area. The present investigation has not only added to the existing knowledge but also brought to light some interesting perspectives. It has been observed that two different types of settlements were in existence during the Harappan period – (i) factory sites and (ii) traders camp sites.

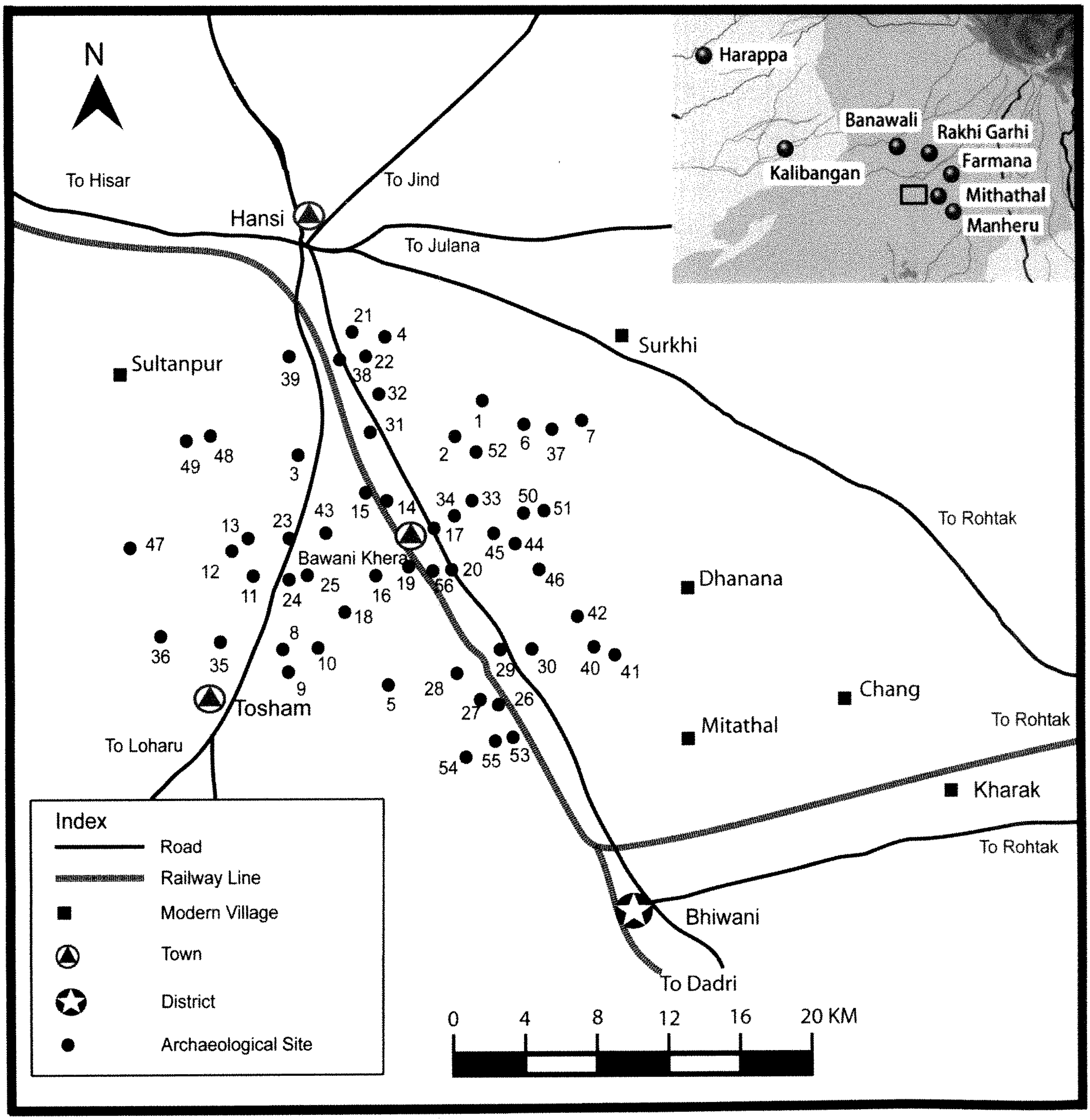
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Fig. 1: Archaeological sites in Southern Haryana

Table 1: Inventory of explored sites

No.	Name	Latitude	Longitude	Cultural Sequence	Size (ha)
1.	Alkhpura-I	29° 01’ 15.7”	76° 03’ 15.1”	EH,MH, LH	3.20
2.	Alkhpura-II	29° 00’ 12.4”	76° 02’ 59.9”	PGW	4.00
3.	Arangnager	29° 00’ 47.6”	75° 58’ 48.4”	E.Med	2.00
4.	Badshi	29° 02’ 46.1”	75° 58’ 10.0”	E.Med,Med.	4.50
5.	Balayali	28° 53’ 25.4”	76° 00’ 00.2”	E.Med, Med.	8.00
6.	Bhani-Jattan	29° 01’ 49.1”	76° 05’ 44.3”	EH, PGW, Med.	3.50
7.	Bhani-Thakran	29° 01’ 00.0”	76° 07’ 00.9”	Med	6.00
8.	Bhurtana-I	28° 54’ 47.1”	75° 57’ 25.7”	EH, MH	2.10
9.	Bhurtana-II	28° 54’ 33.1”	75° 58’ 02.6”	LH	1.80
10.	Bhurtana-III	28° 54’ 35.8”	76° 57’ 59.9”	Med.	2.00
11.	Bohal-I	28° 56’ 19.3”	75° 56’ 02.2”	E.Med, Med.	10.00
12.	Bohal-II	28° 57’ 32.8”	75° 56’ 03.9”	E.Med	4.00
13.	Bohal-III	28° 57’ 37.3”	75° 56’ 19.2”	EH, Hist. E.Med	2.50
14.	Bawani-Khera-I	28° 59’ 04.2”	76° 00’ 18.5”	LH, Hist.	4.00
15.	Bawani-Khera-II	28° 59’ 25.3”	76° 00’ 17.7”	Hist.	1.70
16.	Bawani-Khera-III	28° 56’ 00.2”	76° 00’ 00.9”	E.Med.	12.00
17.	Bawani-Khera-IV	28° 58’ 16.4”	76° 02’ 28.8”	Hist.	8.00
18.	Bawani-Khera-V	28° 55’ 57.0”	75° 59’ 42.6”	LH,GW,BSW, Med.	3.00
19.	Bawani-Khera-VI	28° 57’ 03.3”	76° 01’ 51.5”	E.Med	3.70
20.	Bawani-Khera-VII	28° 57’ 10.0”	76° 02’ 08.2”	E.Med	2.40
21.	Chortapur	29° 03’ 41.8”	75° 59’ 24.1”	EH, E.Med	1.80
22.	Durjanpur	29° 02’ 08.0”	76° 00’ 44.8”	LH	1.05
23.	Jamalpur-I	28° 57’ 01.3”	75° 57’ 00.5”	PGW, E.Med	2.20
24.	Jamalpur-II	28° 56’ 59.8”	76° 57’ 25.3”	Hist.,E.Med	3.05
25.	Jamalpur-III	28° 56’ 39.2”	75° 58’ 11.0”	Hist.	9.30
26.	Jatu-Luhari-I	28° 52’ 05.0”	76° 03’ 15.9”	LH	3.70
27.	Jatu-Luhari-II	28° 53’ 10.4”	76° 03’ 30.2”	E.Med	4.00
28.	Jatu-Luhari-III	28° 54’ 10.2”	76° 03’ 00.9”	E.Med	3.00
29.	Jatu-Luhari-IV	28° 54’ 56.9”	76° 04’ 16.8”	PG	0.90
30.	Jatu-Luhari-V	28° 54’56.6”	76° 05’ 30.7”	LH	1.20
31.	Jitakheri-I	29° 00’ 43.0”	76° 59’ 42.2”	LH	1.80
32.	Jitakheri-II	29° 01’ 18.3”	76° 00’ 15.7”	PGW,BSW, Hist.	2.10
33.	Kheri-Dautapur-I	28° 58’ 46.0”	76° 03’ 13.7”	EH, MH	3.70
34.	Kheri-Dautapur-II	28° 58’ 41.7”	76° 03’ 40.7”	EH, MH	2.05
35.	Kirawar-I	28° 55’ 10.2”	75° 55’ 10.2”	E.Med	2.00
36.	Kirawar-II	28° 55’ 20.5”	75° 53’ 49.5”	E.Med	2.10
37.	Kungar	29° 00’ 03.0”	76° 06’ 00.2”	EH,LH, E.Med.	8.00
38.	Malikpur-I	29° 02’ 43.9”	75° 59’ 17.2”	LH	7.00
39.	Malikpur-II	29° 02’ 51.8”	75° 57’ 38.5”	Med	10.00
40.	Mandhana-I	28° 54’ 17.3”	76° 07’ 49.0”	E.Med	2.20

No.	Name	Latitude	Longitude	Cultural Sequence	Size (ha)
41.	Mandhana-II	28° 54' 00.0"	76° 07' 49.7"	EH,MH,LH	2.80
42	Mandhana-III	28° 55' 22.1"	76° 06' 28.5"	Med	9.30
43.	Paposa	28° 58' 01.6"	76° 59' 32.2"	E.Med	2.00
44.	Pur-I	28° 57' 01.3"	76° 05' 36.3"	Med	6.00
45.	Pur-II	28° 58' 10.1"	76° 04' 33.4"	LH	4.00
46.	Pur-III	28° 56' 28.1"	76° 06' 28.5"	LH, Hist., E.Med	4.00
47.	Ratera	28° 57' 49.1"	76° 52' 19.3"	E.Med, Med.	8.00
48.	Rohnat-I	29° 00' 00.3"	76° 54' 41.8"	E.Med	6.00
49.	Rohnat-II	29° 00' 16.7"	75° 54' 45.8"	EH, E.Med	4.05
50.	Siwada-I	28° 58' 10.3"	76° 05' 45.0"	E.Med	2.10
51.	Siwada-II	28° 58' 01.0"	76° 06' 30.1"	Hist.,E.Med	7.60
52.	Siwana	29° 00' 02.0"	75° 03' 29.0"	E.Med	6.00
53.	Sui-I	28° 52' 00.3"	76° 03' 19.2"	E.Med., Med.	5.80
54.	Sui-II	28° 51' 34.0"	76° 03' 01.0"	E.Med.	20.00
55.	Sui-III	28° 52' 16.5"	76° 04' 13.9"	EH, E.Med.	2.00
56.	Sumra Khera	28° 58' 26.5"	76° 02' 51.2"	Hist.	2.10

EH – Early Harappan; BSW – Black Slip Ware; MH – Mature Harappan; E.Hist. – Early Historical; LH – Late Harappan; Hist. – Historical; PGW – Painted Grey Ware; E.Med. – Early Medieval; GW – Grey Ware; Med. – Medieval

The evidence of factory sites can be seen at Mitathal (Suarj Bhan 1975; Shinde *et al.* 2008: 150-55) and Manheru (Thakran *et al.* 2010). The faience objects in the form of bangles and beads were unearthed on a large scale at Mitathal. In addition, the remains of faience kilns were found located on the surface indicating that Mitathal was a major centre of faience production (Shinde *et al.* 2008: 150-55). The site of Manheru, on the other hand, revealed the evidence of steatite working. It has been established that the Aravalli Hills were the main source of steatite raw material during the Harappan culture (Law 2008: 331). A unique micro steatite bead hoard has been exposed from the early Harappan level at the site (Thakran *et al.* 2010: 128-159). Furthermore, a firing place was located near this hoard of steatite beads with red brunt marks and very fine silver white ash. Could the presence of fire near the hoard be taken as a possible evidence of manufacturing activities? More work and analysis is required to establish this possibility.

The other group of sites, termed as the trader camp sites, are generally located in the vicinity of the Aravalli Hills. Khetri is one of the important sources of Harappan copper artefacts (Agrawal 1971; Agrawal and Kumar 1982). In addition, copper has also been reported from Southern Haryana, especially from Khalra Hill and Teejanwali Hill, Mahendragarh District (Gupta and Kanwar 1969: 50). There is evidence of ancient copper working on both of these hills. The Aravalli Hills (especially in Southern Haryana) are also famous for varieties of ores and minerals, stones and metals such as tin, gold, silver, mica, quartz, limestone, garnet, barytes, manganese, kyanite and marble (Gupta and Kanwar 1969; Grover and Kumar 1980; Kochhar 1982; Dey 1985; Kochhar *et al.* 1999). Most of the Harappan settlements located in this region are small and might have been involved in the procurement and trade of these material to the bigger settlements located in the main Sarasvati-Drasdwati Valley. Thus, these Harappan sites not only played a vital role in the procurement of necessary raw material, which was later used for the manufacture of precious items, but also acted as links between the Harappan culture and the Ganeshwer-Jodhpura culture. It has been surmised that the source was controlled by the Ganeshwar-Jodhpura people and that they supplied the raw materials to the Harappans.

The ceramics of the early Harappan culture are similar to the Siswal culture. The Siswal culture played an important role in the evolution of Harappan

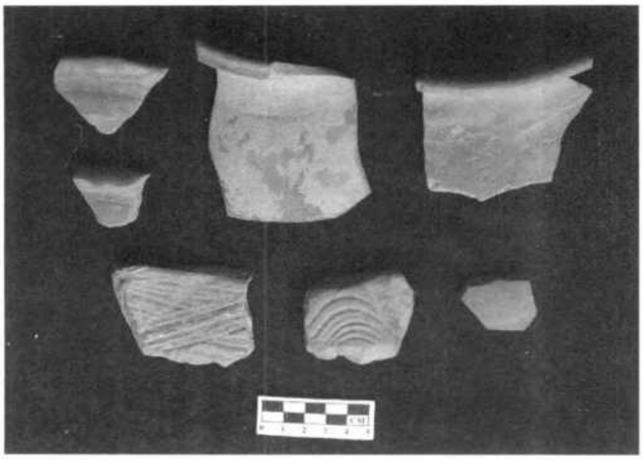

Fig. 2: Early Harappan pottery

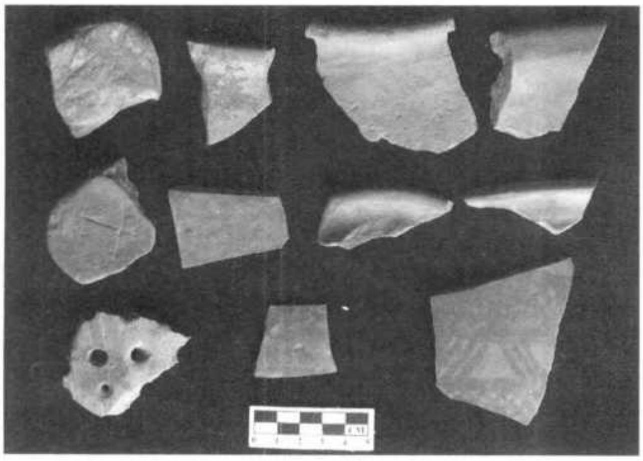

Fig. 3: Mature Harappan pottery

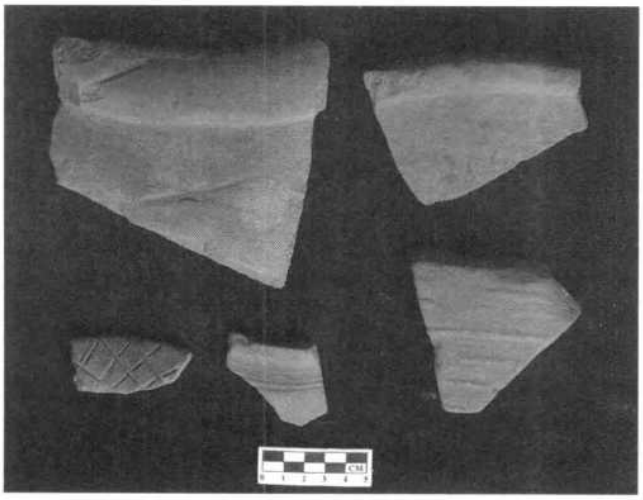

Fig. 4: Late Harappan pottery

culture in Sarasvati-Drasdwati Valley. As many as eleven early Harappan sites were studied during the recent exploration, of which ten sites were located on the alluvial plain, and one was located in a sandy area. The early Harappan ceramics are broadly divided into red, buff, and, grey types. The main shapes include vase, basin, jar, bowl, dish, storage, and, jar. The chief motifs noticed on the early Harappan pottery include horizontal, vertical and curved lines, zig-zig pattern, and wavy rope and loop designs. The painted designs were found to be

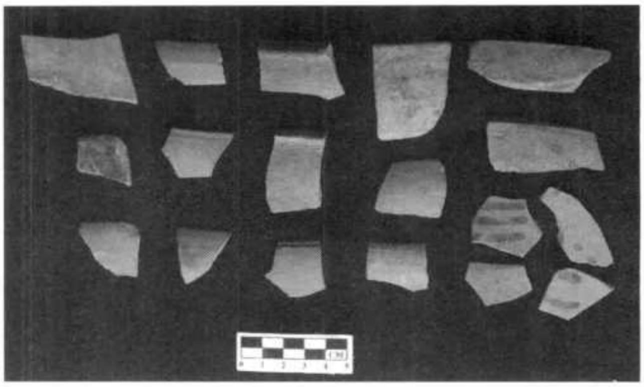

Fig. 5: Painted Grey Ware

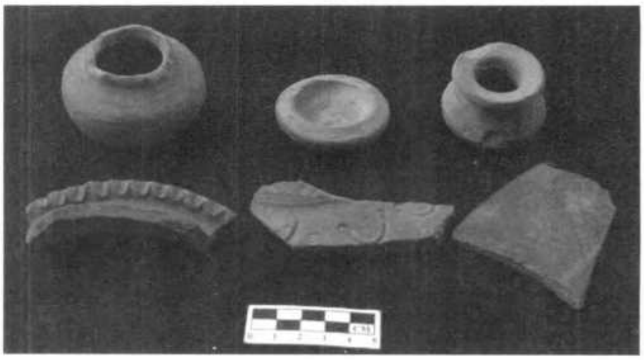

Fig. 6: Early Historic and Historic pottery

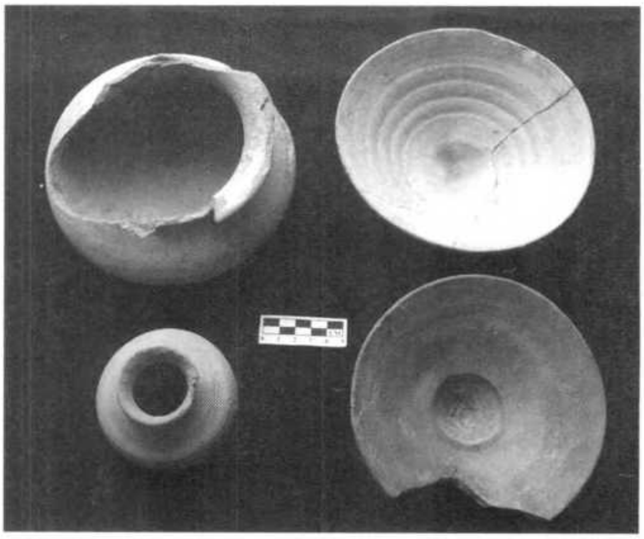

Fig. 7: Early Medieval and Medieval pottery

generally located at rim, neck and shoulder portions. In addition, some sherds were found with incised decoration. The Red ware sherds were found in large numbers and were similar to Kalibangan-I fabric A to D. This recent exploration has also brought to light the Buff ware (Fabric E) and Grey ware (Fabric F), though limited in number and without any painted designs.

At Mitathal, the Siswal culture continues up to Mitathal IIA period without any stratigraphic break (Suraj Bhan 1975). Mitathal IIA revealed both the characteristic of Mature Harappan phase and the late Siswal phase. This area has shown evidence of a number of Mature Harappan settlements, all of which are rural in nature. Although, these settlements revealed a majority of characteristic features of the Siswal culture, but elements generally associated with the classical Mature Harappan were limited in number. Hence, it is really difficult to identify sites associated with the Mature Harappan culture only on the basis of material collected during the exploration. Only five sites have revealed the typical classical Harappan ceramics in this area. The Mature Harappan pottery collected from the sites have been made on fast wheel, well-fired, has a red slip, painted with black colour, and are medium to fine in fabric. The main shapes include perforated jars, goblets, storage jars and dish. The pottery of this area, during the Mature Harappan period, was known by the painted designs that were generally geometrical with black colour on the fine red surface.

The Late Harappan settlements represent the de-urbanised phase of the Siswal culture. Mitathal IIB period is representative of all the Late Harappan sites in this region and is one of the best examples of the devolution of the Siswal culture. According to Shaffer (1986: 216) "Mitathal IIB pottery represents a continuous development of the Siswal ceramic tradition, which might be called Siswal C phase". The term, 'Degenerate Siswal', was suggested by Suraj Bhan (1975: 116) for this phase. Of the thirteen sites of Late Harappan phase ten sites are located in the alluvial plain while three are in the sandy area. The Late Harappan pottery also shows the degeneration in the form of fabric, designs and decoration. Dull Red ware and rusticated ware are found in large quantities from these Late Harappan sites, besides a small number of incised and grey ware.. The main shapes of pottery in this period include vase, bowl, storage jar, basin and dish. The Late Harappan period has mostly geometric designs including horizontal and vertical lines, zig-zig patterns, dots, latticed and loop designs.

Bhagwanpura excavation (Joshi 1993) revealed overlapping of the Late Harappan and Painted Grey Ware (PGW) culture. In Haryana, the PGW sites were found in two contexts: with late Harappan and without Late Harappan. During the exploration, five new PGW sites were found, three of which are situated in the alluvial plain, while two are in the sandy area. All the sites belong to the second category, i.e. without Late Harappan culture. From the chronological point of view, the extent of PGW culture is very interesting in this area. The main shapes in PGW pottery are bowl and dish. The pottery surface is smooth and grey to ashy-grey in colour. It has a compact section and thin core. The PGW sherds are decorated in black with simple horizontal bands, rows of dots and dashes, group of vertical and oblique lines, concentric circles and semicircles.

The Historical settlements of this area can be placed around the third century B.C. In the recent exploration not a single NBP sherd was found. Naurangabad is the type site of the Early Historic and Historical period in Southern Haryana. It occupies an area of about 23 ha with a height of about 11 m above ground level (Sengar 2004-05: 191-195). The Punch-marked, un-inscribed, Yaudheya, Indo-Greek, Kushana and Gupta coins have been reported from this site (Parmar 2008: 63-64; Monuments and Sites in Haryana 2009: 88). During the recent exploration, eleven settlements were found. Only five sites show occupation up to the early Medieval times. The major shapes of pottery of the Historic period include incurved-rimmed bowls, vases, spouted pots, basins, cups, lids and stamp design pottery.

This exploration has brought to light 36 early Medieval and Medieval settlements. Most of these settlements are presently occupied by villages. The early Medieval period does seem to have witnessed a growth in population compared to the Historic period, thus exhibiting a change in the socio-economic way of life associated with it. These early Medieval and Medieval sites played an important role in the growth of Hansi and Meham as important regional centres. Hansi is a prominent early Medieval city, with the presence of a fort from the Prithvi Raj Chauhan period, and, Meham also has many monuments belonging to this period (Parmar 2009). The pottery consists totally of Red ware, and the main shapes are knife-edged bowls, basins, dishes, *handis*, jars, lids, and vases.

Conclusions

The archaeological investigation in Southern Haryana suggests that this region witnessed the emergence of settled life from the Early Harappan period, which continued up to the Medieval times, and/or in some cases still continues to the present day. The origins of the Hakra cultural phase could have happened in this part of the Sarasvati-Drasdwati Valley and slowly spread towards the western part, particularly in the Hakra Basin. Because of the closeness of this region to mineral rich Rajasthan, the area could have witnessed a change possibly in economic conditions and a number of factory as well as trade camp sites emerged, which ultimately formed the base of the urbanization leading to the Mature phase of the Harappan civilization.

Acknowledgments

The author is extremely thankful to Drs. Vasant Shinde, Vijay Sathe and R.C. Thakran for logical support and valuable suggestions. He also thanks Vikas, Appu, Pankaj, Sandeep, Nilesh for helping in various aspects to complete this research paper and special thanks to Dr. Amar Singh, who not only helped to identify culture sequence but also gladly helped in the field investigations.

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Vivek Dangi, *Man and Environment* XXXVI(2): 66-87 [2011].
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Explorations along the Ghaggar River and Sirhind Nala in Haryana and Punjab

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Abstract

This paper is a preliminary report of the archaeological exploration, whose primary focus was a village-to-village survey of Tohana tehsil of Fatehabad district, Haryana, besides a revisit of a few sites in Mansa and Sangurur district of Punjab. During August-September 2008 a total of 60 sites were visited and documented. This study aims at presenting a holistic understanding of the origin and development of the early faming cultures in the region, and, to give general information about the archaeological sites in the region. The material remains collected during the survey such as pottery, beads and lithic objects are also discussed in detail.

Introduction

The study area lies between the Indus and Ganga hydrological systems and is located in the most fertile terrain of the country. It is a vital region for the study of cultural transitions in general and Harappan civilization in particular (rise and fall) during the 3rd and 2nd millennia BCE. In this area, the River Ghaggar played an important role in attracting the early farming communities. The credit for initiating archaeological field work in this area goes to Suraj Bhan (1972, 1975) as he explored hundreds of sites, and conducted vertical excavations at Mitathal and Siswal. Thereafter, in 1982, Chander Pal Singh and Dhoop Singh of the Department of Archaeology and Museum, Haryana conducted archaeological explorations in this region and discovered a number of sites (*IAR* 1985-86: 25-29). J.P. Joshi and Madhu Bala also reported some sites in 1980s (Joshi 1993; Madhu Bala 1992). Krishana of the M.D. University, Rohtak conducted explorations in the Ratia tehsil in 2004 (Krishana 2005: 12-32). Besides explorations, excavations of a few sites such as Banawali (Bisht 1982: 113-124), Kunal (Khatri and Acharya 1995: 84-86), Dhelwan (Madhu Bala 2000: 42-44), Bhirrana (Rao *et al.* 2005: 60-68) and Burj (Singh *et al.* 2010a and b) have largely contributed to the understanding of the pre urban, urban and post urban phases of the Harappans in this region. With this archaeological background, a village-to-village survey was carried out in the Tohana tehsil of Fatehabad district in Haryana. Sites in the Mansa district of Punjab along the Sirhind *nala* were also surveyed and a few sites in the Ratia tehsil of Fatehabad were revisited. These explorations were conducted as a part of the doctoral dissertation in 2008.

Topography and Drainage System

The area is a part of the Ghaggar Plains (210-220 m AMSL) and its southern and western portions are marked by a sluggish transition to the Thar Desert. The main features of the topography are the Aeolian deposits of varying thickness overlying the Pleistocene alluvium that can be observed in the western and northern side of the area. The area can be divided in three topographic unites – sub-recent alluvial plain, Late Quaternary to sub-recent sand dune area and plain with sand dunes. The River Ghaggar originates in the Sirmaur district of Himachal Pradesh and is perennial only in its upper reaches. During the monsoons it receives enough water from its tributaries (Markanda, Rakshi, Natkti, etc.). Sometimes it floods a large part of the Punjab, Haryana and Rajasthan, and enters Pakistan near Anupgarh (District Sri Ganganagar, Rajasthan) where it is known as Hakra, Raini, Nara and Wahid. Sirhind *Nala,* a small seasonal stream, originates near Rupnagar and flows through Malerkotla tehsil in a south-westerly direction and loses itself in stagnant waters near the town of Sunam, and then it enters district Mansa. Recently it has been channelized. Musa *Khera* (village Ratta Theh) is a swamp in the region, which is surrounded by high sand-dunes towards east, west and south, and the River Ghaggar passes by on its northern side.

Received : 15-07-2011
Revised : 21-09-2011
Accepted : 15-12-2011

Methodology

The present researcher conducted an extensive village-to-village survey in the region (Table 1; Figs. 1-2). Collection of pottery and other remains from the surface and exposed sections was done. The main emphasis was on locating sites and observing the distribution pattern of the cultural remains in the area. The date of the sites was decided on the basis of occurrence of diagnostic ceramic shapes of various ancient periods. The estimation about the size of the sites was made on the basis of the area, up to which cultural deposit was found. Published literature and survey reports including unpublished dissertations were examined and their data was included in this study.

Ceramic Sequence of the Study Area

A large number of pottery specimens were collected during the survey (Table 2; Figs. 3-7). Specimens from Banawali, Bhirrana, Burj, Dhelawan, Lakmirwala, Narenderpura and Gurni Kalan were included in this study. The earliest set of ceramics is named as Ghaggar-Hakra, first reported from Kunal (Khatri and Acharya 1995: 84) and Bhirrana in association with the dwelling pits (Rao *et al.* 2005; 2006). The excavation at Girawad also yielded identical assemblage (Uesugi 2011: 40-239) with similar context. Similar pottery has been reported from many sites in Hissar, Jind and Rohtak districts of Haryana (Dangi 2009a, 2009b). Scholars have termed this assemblage as Pre-Harappan or Hakra (Khatri and Acharya 1995: 84; Rao *et al.* 2005; 2006) or Regional Hakra (Shinde *et al.* 2008: 135), but the term Ghaggra-Hakra is more appropriate because this assemblage has some generic similarities with the Hakra ware of Cholistan region. On the basis of ^{14}C dates from Bhirrana, Kunal and AMS dates from Girawad, this ceramic tradition can be placed in the middle and the later half of the fourth millennium BCE. In the present study area, six sites yielded

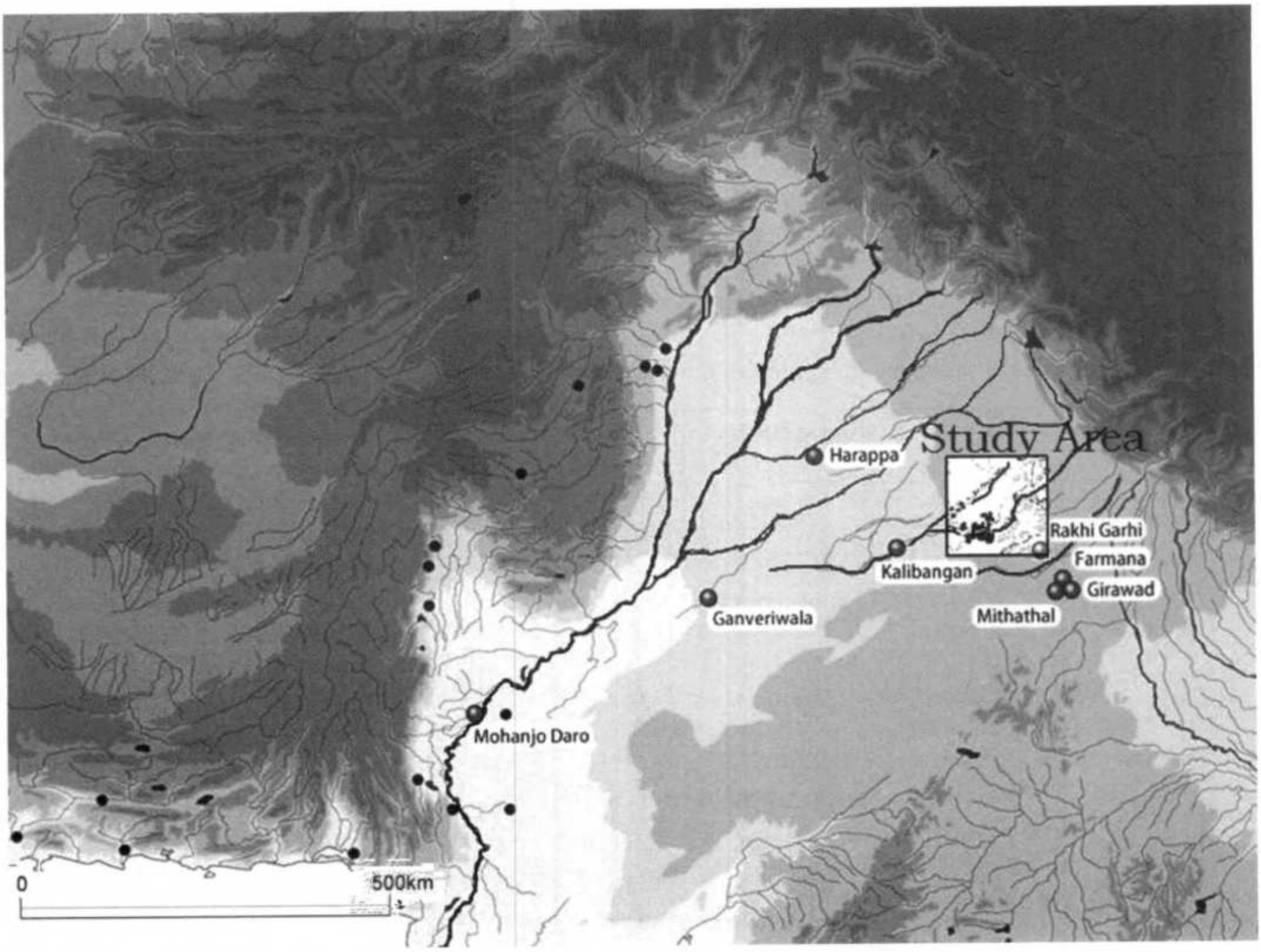

Fig. 1: Map showing location of the study area

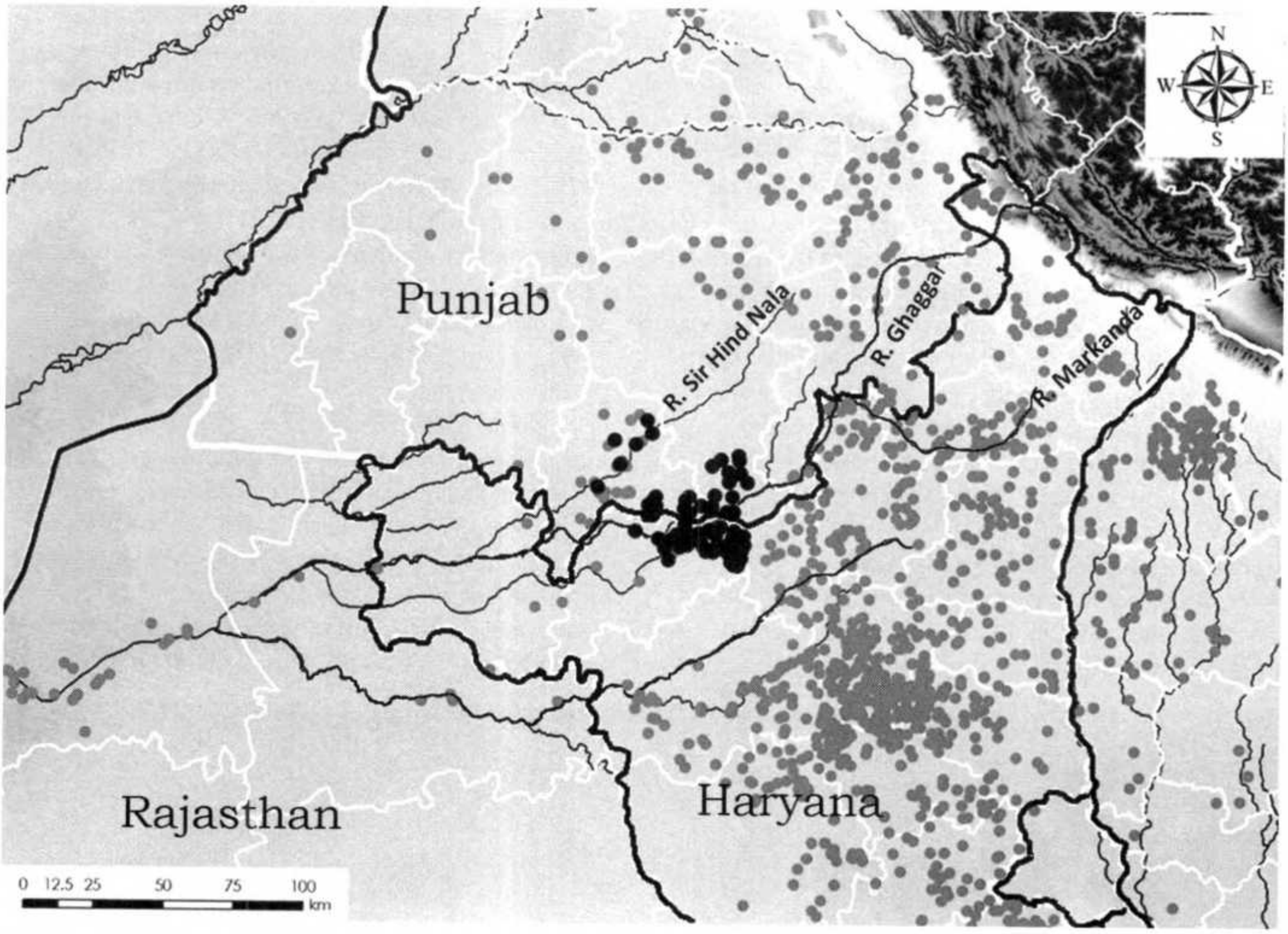

Fig. 2: Map showing explored sites with major water channels

Table 1: Showing explored sites along with geo-references and cultural sequence

Sr. No.	Site name	District	Geo-cordinates	Size in Ha	Previous work	Cultural association
1	Akanwali	Fatehabad	29° 39' 48.1" N; 75° 47' 06.8" E	2	Dangi 2010: 32	EH, Hist, Med
2	Banawali	Fatehabad	29° 59.7' 56"N;75° 39" 28" E	7	EH, MH, LH (Bisht 1982)	EH, MH, LH
3	Bhirrana	Fatehabad	29° 33'16.8"N; 75° 32' 52.8" E	2	PH, EH, MH (excavated) (Rao *et al.* 2005: 69-75)	GH, EH, MH
4	Bhodia	Fatehabad	29° 37'32" N; 75° 55'36.7" E	2	Dangi 2010: 417	Hist
5	Bhurtoli	Fatehabad	29° 46'12.8" N; 75° 44'11.8" E	2	Dangi 2010: 417	Med
6	Bodhi	Fatehabad	29° 38'55.2"N; 75° 47'41.9" E	4	Dangi 2010: 417	Hist, Med
7	Budhanpur	Fatehabad	29° 42'53.9" N; 75° 48'33.5" E	2	Dangi 2010: 417	Hist, Med
8	Burj	Fatehabad	29° 39'26.1"N; 75°38'30.1"E	3	LH, PGW (*IAR* 1966-67: 11)	GH, EH, PGW, Hist

Sr. No.	Site name	District	Geo-cordinates	Size in Ha	Previous work	Cultural association
9	Chander Kalan	Fatehabad	29° 38'48.8" N; 75° 49'22.5" E	2	Dangi 2010: 36	PGW, Hist
10	Chander Khurd		29° 39'05.6" N; 75° 49'53"E	1	Dangi 2010: 36	PGW, Hist, Med
11	Chandpura	Fatehabad	29°47'42"N & 75°43'00"E	1.5	Dangi 2010: 418	Hist, Med
12	Damkora		29° 42'53.9" N;75° 48'33.5" E	2	Dangi 2010: 148	Hist, Med
13	Dangra	Fatehabad	29° 41'20.8" N; 75° 53'33.6" E	3	Dangi 2010: 418	PGW, Hist
14	Dharsul Kalan	Fatehabad	29° 40'39.3" N; 75° 44'12.1" E	2	Dangi 2010: 418	EH, Hist, Med
15	Dher	Fatehabad	29° 42'15.8" N; 75°46'15.3" E	3	Dangi 2010: 36	PGW, Hist, Med
16	Ghaswa-1	Fatehabad	29° 41'06.8" N; 75° 40'10.3" E	1	EH, LH (Suraj Bhan 1972: 36)	GH, EH
17	Ghaswa-2	Fatehabad	29° 42'09" N; 76° 46'24.7" E	1.5	EH (Suraj Bhan 1972: 36)	EH
18	Gullarwala	Fatehabad	29° 42'10.7" N; 76° 46'25.8" E	1	Dangi 2010: 37	EH, MH, Hist
19	Haderpur	Fatehabad	29° 42'32.8" N; 75°47'59.7 E	2	Dangi 2010: 38	LH, Hist, Med
20	Jakhal	Fatehabad	29° 47'19.6" N; 75° 49'06.7" E	3	Dangi 2010: 38	EH, Hist
21	Jamalpur Shekhal-1	Fatehabad	29°41'59.1" N;75°50'05.4"E	4	Dangi 2010: 38	LH, Hist, Med
22	Jamalpur Shekhal-2	Fatehabad	29°42'15.1 N; 75°49'21.6"E	3	New Site	Med
23	Kamalwala	Fatehabad	29° 36'10.8" N; 75° 53'55.6" E	1	Dangi 2010: 38	EH, Hist
24	Kanhari-1	Fatehabad	29° 40'44.3" N; 75° 56'09.2" E	1	Dangi 2010: 420	Hist
25	Kanhari-2	Fatehabad	29° 39'59.8" N; 76° 56'19.7" E	2	Dangi 2010: 420	EH, PGW, Hist
26	Karandi	Fatehabad	29° 42'24.07" N; 75° 41'18.8" E	2.65	Dangi 2010: 420	Hist, Med
27	Kaul Garh	Fatehabad	29° 41'16.8" N; 75° 37'14.3" E	2	Dangi 2010: 39	EH, PGW, Hist
28	Kullan	Fatehabad	29°40'02.8" N;75° 43'45.3" E	2	Dangi 2010: 39	PGW, Hist, Med
29	Kunal	Fatehabad	29° 37'26" N; 75° 39'50.9" E	1.2	PH, EH, MH Excavated (Khatri and Acharya 1995: 84-86)	GH, EH, MH, PGW
30	Lalauda	Fatehabad	29° 38'36.5" N; 75° 52'28.9" E	5	Dangi 2010: 40	Hist
31	Laluwala	Fatehabad	29° 38'07.1" N; 75°27'28.8" E	2	Dangi 2010: 421	EH, LH
32	Loha Khera	Fatehabad	29° 40'07.9" N; 75° 54'31.4" E	4	Dangi 2010: 41	PGW, Hist, Med
33	Malaheri	Fatehabad	29° 38'59.2" N; 75°55'42.7" E	2	New Site	Hist, Med
34	Mirrana	Fatehabad	29° 42'47.7" N; 75° 32'08." E	1	Dangi 2010: 41	PGW
35	Mundhlian	Fatehabad	29° 45'26.2" N; 75° 43'21.6" E	1	Dangi 2010: 41	EH, Hist
36	Nangla	Fatehabad	29° 36'46.8" N; 75°53'18.9" E	3	Dangi 2010: 423	Med
37	Nangli-1	Fatehabad	29° 36'02.4" N; 75° 54'46.9" E	5	Dangi 2010: 41	EH, Hist
38	Nangli-2	Fatehabad	29° 36'10.8"N; 75° 53'55.6" E	5	Dangi 2010: 423	Hist, Med
39	Ratta Theh-1	Fatehabad	29° 42'56.5" N;75° 43'10.8" E	1	MH, LH (Suraj Bhan 1972: 37)	EH

Sr. No.	Site name	District	Geo-cordinates	Size in Ha	Previous work	Cultural association
40	Ratta The-2	Fatehabad	29° 44'02.4" N; 75° 43'08" E	5	Dangi 2010:424	Hist
41	Ratta Khera	Fatehabad	29° 39'54.8" N; 75°52'26.2" E	5	Dangi 2010:424	Hist
42	Sadhanwas	Fatehabad	29° 47'31.8" N; 75° 46'44.3" E	2	Dangi 2010:424	Hist, Med
43	Samain	Fatehabad	29°37'32" N; 75°55'36.7"E	2	Dangi 2010:42	PGW
44	Sidhani	Fatehabad	29°48'38.3" N;75°43'17.5"E	6	Dangi 2010:424	Hist, Med
45	Talwara	Fatehabad	29° 46'39.1" N; 75° 48'48.3" E	3	EH, PGW (Suraj Bhan 1972: 37), (Dangi 2010: 42)	GH, EH, PGW, Hist
46	Zabatwala	Fatehabad	29° 3'39.2" N;75° 42'00.1" E	3	Dangi 2010: 425	Med
47	Bir Khurd	Mansa	30° 03'56.8" N; 76° 34'44.4" E	2	Dangi 2010: 126	EH, Hist
48	Churad	Mansa	29° 49'33.9" N; 75° 49'47.3" E	7	Dangi 2010: 126	LH, Hist
49	Dhelawan	Mansa	30° 01'24.3" N; 75° 35'45.8" E	12	EH, MH, Hist, Med (excavated) (Madhu Bala 2000: 42-44)	EH, MH, LH, Hist, Med
50	Dhindsa	Mansa	29° 53'43.7" N; 75° 55'35.9" E	2.5	Dangi 2010:127	LH, PGW
51	Ganothi	Mansa	29° 46'22.5" N; 75°54'00.7" E	2	Dangi 2010:127	LH
52	Gudhani Kalan	Mansa	29°46'20.4"N 75°52'30.7"E	2	Dangi 2010:127	EH, Hist
53	Gurni Kalan	Mansa	29° 59'21.5" N; 75°32'10.8" E	7	EH, LH, 1200 x 1200 m in size (144 hectare) (Joshi, J.P.1993)	EH, LH
54	Lakhmirwala	Mansa	29°51'13.9"N 75°23'46.5"E	5	EH, MH, 1500 x 1500 m in size (250 hectare) (Joshi 1993)	GH, EH, MH
56	Moonak	Mansa	29°49'12.9" N;75°53'45.8"E	3	PGW (Madhu Bala 1992: 70)	PGW
57	Narendrapura	Mansa	29° 55'33" N; 75° 28'44.8" E	5	Dangi 2010: 128	
58	Patal Kalan	Mansa	29° 54'01.7" N; 75°52'50.4" E	2	Dangi 2010: 129	EH, Hist
59	Roandh Kalan	Mansa	29° 45'53.3" N; 75° 34'53.8" E	3	Dangi 2010: 129	EH, Hist, Med
60	Saspalia	Mansa	29° 49'21.9" N; 75° 36'43.3" E	2	Dangi 2010: 129-30	PGW

GH = Ghaggar Hakra, EH = Early Harappan, MH = Mature Harappan, LH = Late Harappan, PGW = Painted Grey Ware, Hist = Historical, Med = Medieval

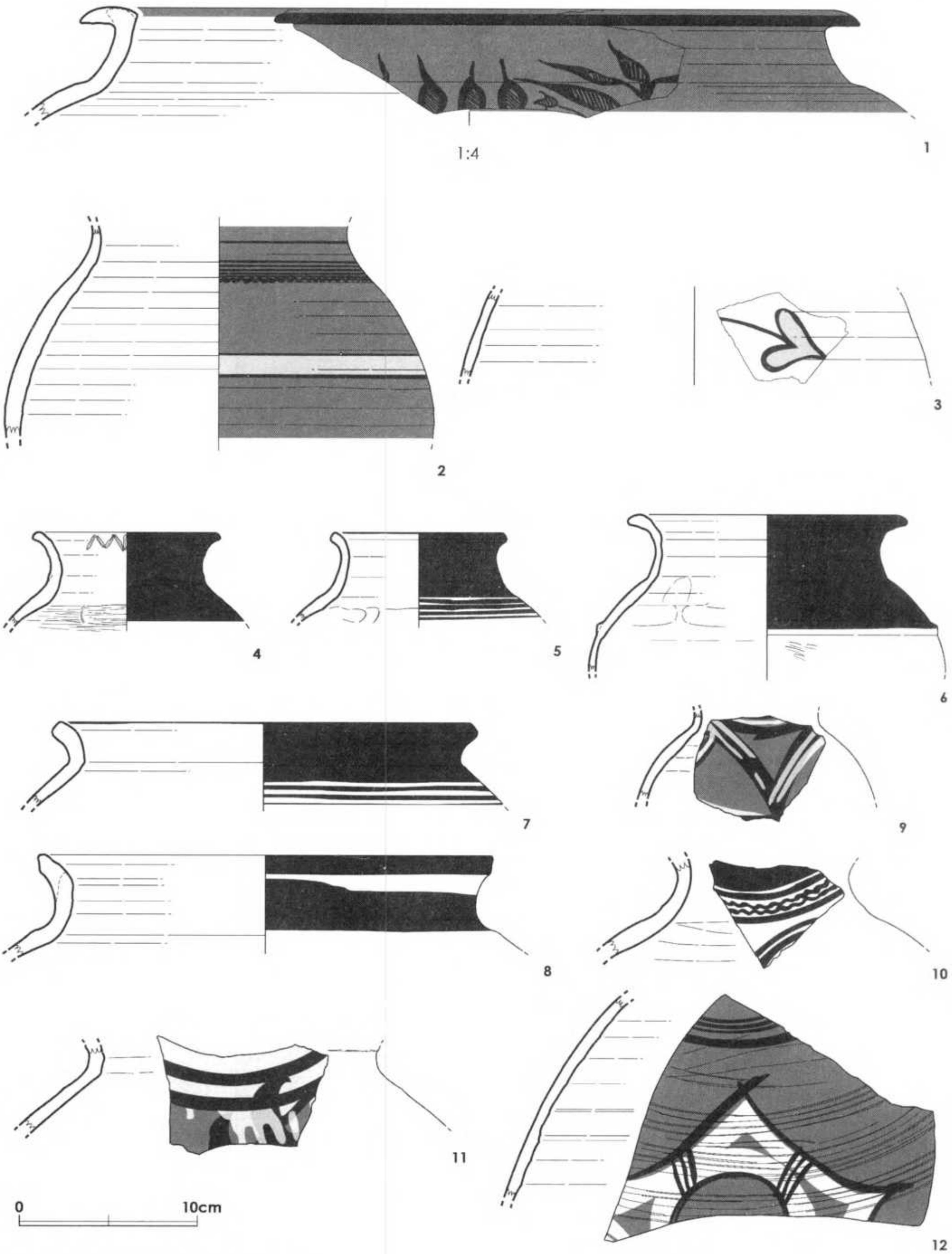
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Fig. 3: Early and Mature Harappan pottery

pottery of the Ghaggar-Hakra ceramic tradition. From Kunal and Bhirrana sherds of this tradition were found in the stratigraphic context.

The second type of protohistoric pottery belongs to the Early Harappan period, generally referred to as the Sothi-Siswal assemblage. It exhibits some influence of the Kot Diji elements. On the basis of ^{14}C dates from Kalibangan and Bhirrana, this assemblage can be dated to the first half of the third millennium BCE. The analysis of pottery indicates that it evolved from the Ghaggar-Hakra ceramic tradition. Most of the pottery types/wares (e.g. chocolate/black slipped ware and other features such as incised decoration, bi-chrome ware, grey ware) of the Ghaggar-Hakra pottery tradition also continue in this period.

Ghosh (1989) pointed out that there is regional variation of ceramics in the Ghaggar Basin and designated it as the Sothi ware. It was recovered for the first time in the stratigraphic context at Kalibangan. Pottery assemblage of Kalibangan I was classified into six different fabrics (*IAR* 1962-63: 20-23). A few years later, Bhan (1972: 315) brought to light another assemblage from Mitathal and Siswal in Haryana, somewhat comparable to Kalibangan I, which he identified as Siswal ware (Bhan 1975: 103-109). Hence, the term Sothi-Siswal is used by most of the scholars. The representative shapes in this assemblage are jars, vases, bowls, basins and handled pots/basins. There are variations in size. Most of the examined sherds are decorated with black bands

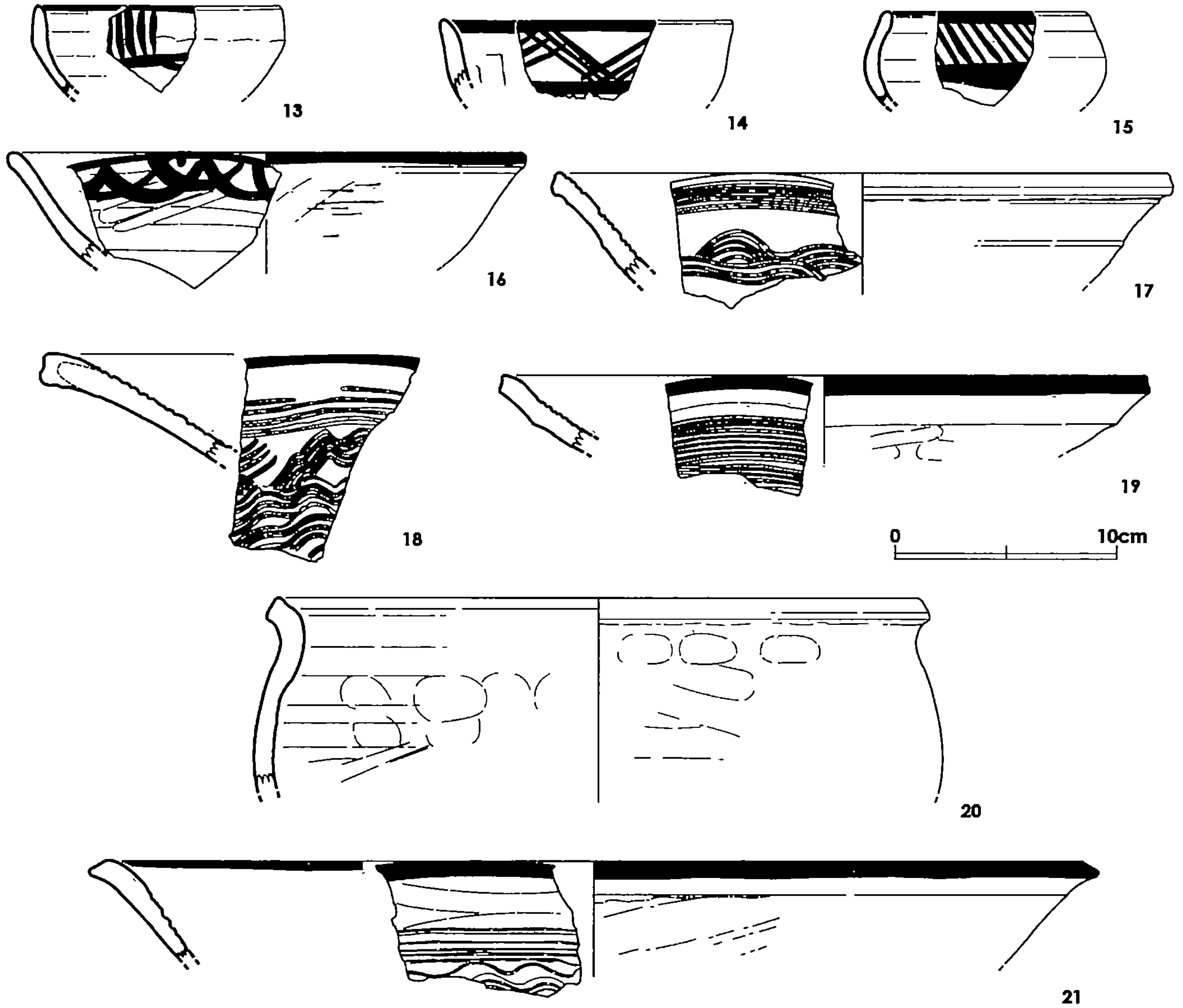

Fig. 4: Early and Mature Harappan pottery

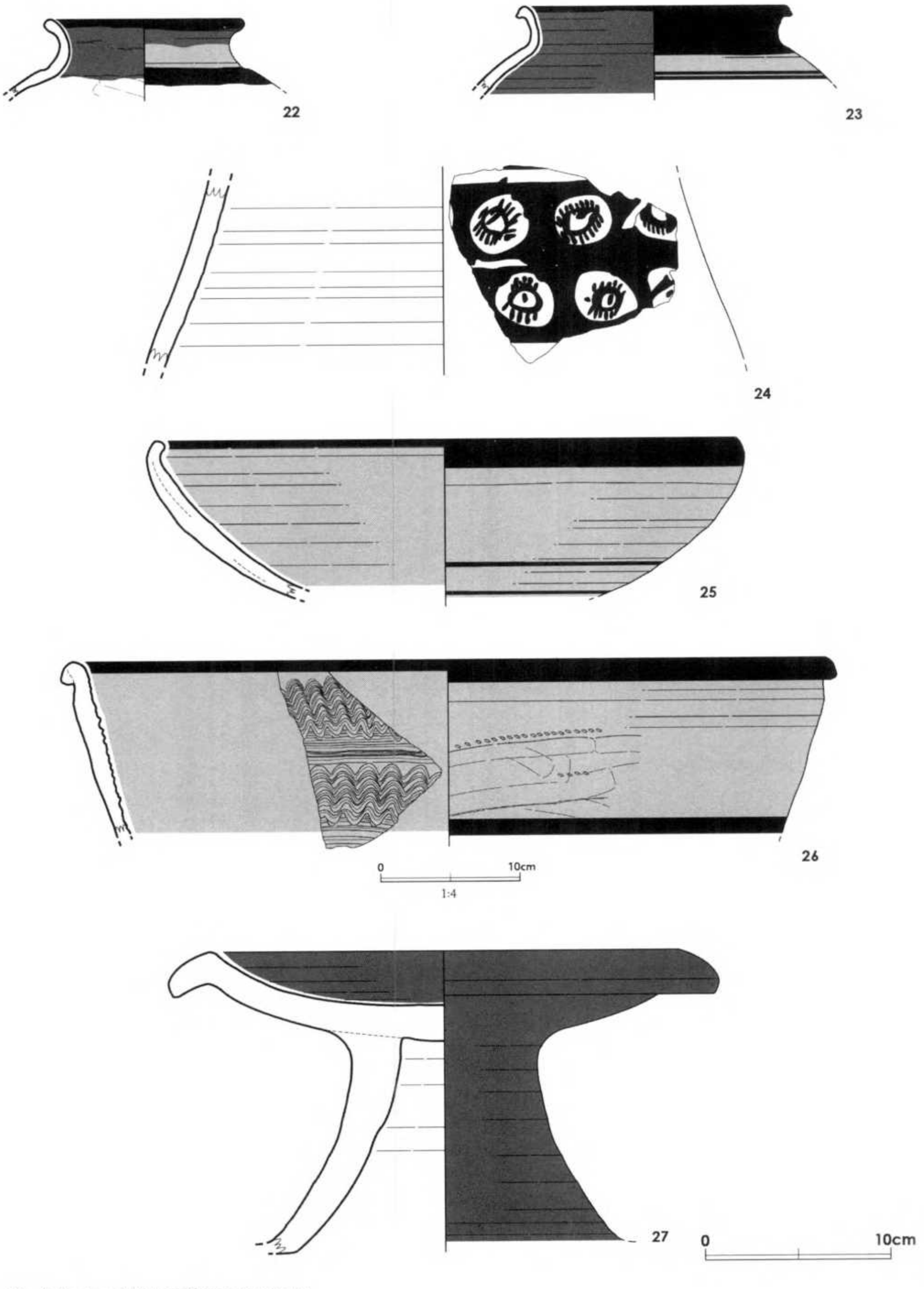
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Fig. 5: Early and Mature Harappan pottery

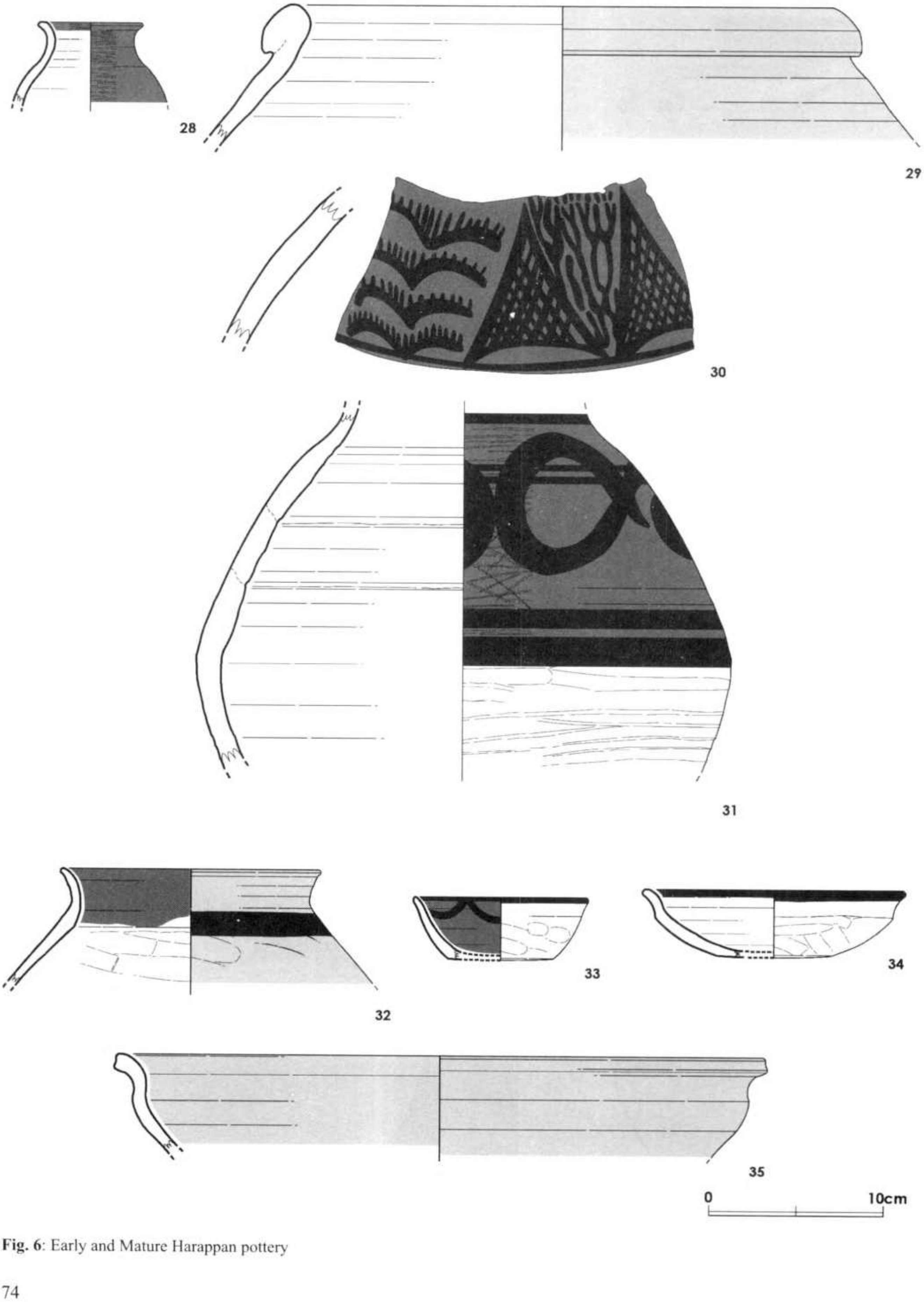
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Fig. 6: Early and Mature Harappan pottery

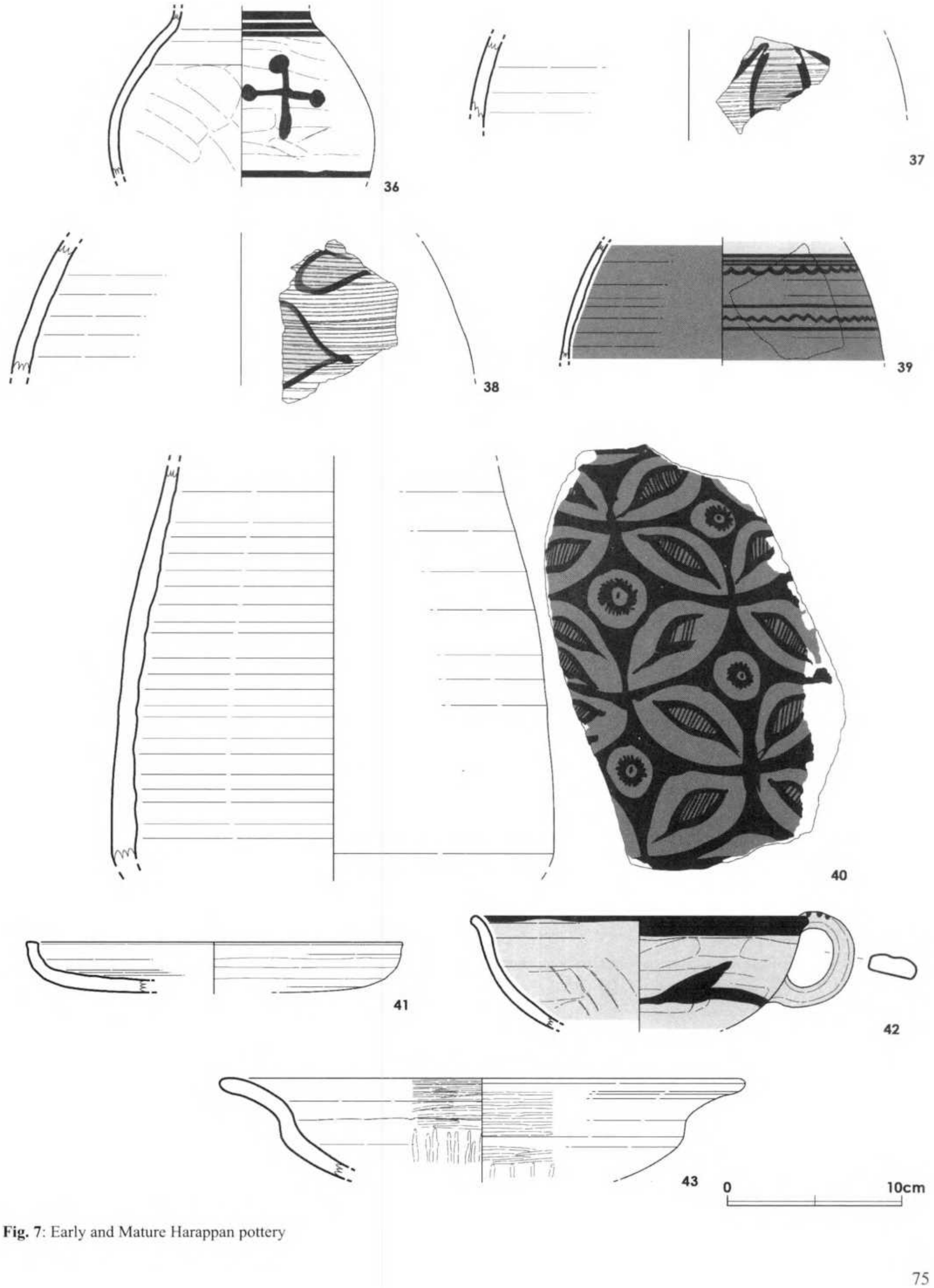
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Fig. 7: Early and Mature Harappan pottery

Table 2: Characteristic shapes of the ceramics

S.No.	Shape	Description	Period	Provenance
1	Storage jar	Treated with red slip and decorated with leaf motif.	Mature Harappan	Banawali
2	Vase	Polychrome, decorated with thin black horizontal bands and on broad white band	Early Harappan	Burj
3	Vase	Bi-chrome, papal leaf motif, decorated out-lined with black filled with white	Early Harappan	Burj
4	Vase	Treated with black slip, 'V' shaped post firing graffiti.	Early Harappan	Bhirrana
5	Vase	Painted with broad black band around rim and neck, four parallel bands around shoulders.	Early Harappan	Bhirrana
6	Ledged jar	Upper body is painted with black broad band.	Early Harappan	Bhirrana
7	Vase	Painted with broad black band around rim and neck, three parallel bands around shoulders.	Early Harappan	Bhirrana
8	Vase	Angular rim; rim and neck decorated with two black bands.	Early Harappan	Bhirrana
9	Vase	Polychrome, decorated with black and white curvilinear lines.	Early Harappan	Bhirrana
10	Vase	Painted with two black and wavy lies bordered by two other parallel bands, below them two curvilinear lines.	Early Harappan	Bhirrana
11	Vase	Polychrome, slipped with red and painted with black and white bands and curvilinear strokes.	Early Harappan	Bhirrana
12	Vase	Decorated with five black bands and a star like motif consisting of black out line, filled with white.	Early Harappan	Bhirrana
13	Bowl	Carinated bowl, decorated with two black band around rim and body and five vertical strokes.	Early Harappan	Bhirrana
14	Bowl	Decorated with intersecting parallel lines in oblique directions and two bands around rim and belly.	Early Harappan	Bhirrana
15	Bowl	Convex side bowl, decorated with parallel oblique line bordered by horizontal bands.	Early Harappan	Bhirrana
16	Bowl	Wide mouth, outward rime, decorated with intersection semicircles on the internal surface.	Early Harappan	Bhirrana
17	Bowl	Decorated with parallel horizontal grooves on the neck portion and wavy grooves on the internal surface.	Early Harappan	Bhirrana
18	Bowl	The rim portion is painted with a black band and parallel horizontal grooves are executed on the internal side of the body portion.	Early Harappan	Bhirrana
19	Bowl	The rim portion is decorated with a black band. The internal surface is executed with parallel horizontal and wavy grooves.	Early Harappan	Bhirrana
20	Bowl	having a wide mouth with a short and out-curved neck and an angular	Early Harappan	Bhirrana
21	Bowl	The rim portion is painted with a black band. The internal side of the body is executed with parallel horizontal and wavy grooves. On the external surface slurry is applied.	Early Harappan	Bhirrana
22	Vase	Bi-chrome, decorated with black and white bands around rim neck and shoulder.	Early Harappan	Dhelawan
23	Vase	Bi-chrome, decorated with black band around rim and neck, white around shoulder.	Early Harappan	Dhelawan
24	'S' Shaped jar	Decorated with sun motifs, bordered by thick black bands	Mature Harappan	Dhelawan
25	Basin	Decorated with three black bands	Early Harappan	Dhelawan
26	Basin	Decorated with two black bands outer surface and the internal surface is decorated with comb incised wavy and horizontal grooves.	Early Harappan	Dhelawan
27	Dish-on-stand	Having short and wide pedestal and slightly dropping rims.	Mature Harappan	Dhelawan
28	Vase	Treated with black slip and is finished by streak burnishing.	Early Harappan	Gurni Kalan

S.No.	Shape	Description	Period	Provenance
29	Jar	Having beaked rim, treated with white slip.	Late Harappan	Gurni Kalan
30	Jar	Decorated with plant motifs and hatched triangles	Late Harappan	Gurni Kalan
31	Jar	Treated with red slip and painted with black bands and a horn like motif, lower part is applied with slurry and is slightly grooved.	Late Harappan	Gurni Kalan
32	Vase	Treated with dull orange slip and decorated with a black around shoulder	Early Harappan	Narenderpura
33	Bowl	Decorated with black band around rim and internally decorated with semi circles.	Early Harappan	Narenderpura
34	Bowl	Decorated with black band around rim	Early Harappan	Narenderpura
36	Vase	Decorated with black bands and crisscross dots	Ghaggar-Hakra	Lakhmirwala
37	Vase	Bi-chrome, decorated with pipal leaf, out lined with black and filled with white.	Early Harappan	Lakhmirwala
38	Vase	Bi-chrome, decorated with pipal leaf, out lined with black and filled with white.	Early Harappan	Lakhmirwala
39	Vase	Treated with red slip, decorated with black horizontal and wavy bands (Kot Dijian influence).	Early Harappan	Lakhmirwala
40	'S' Shaped jar	Treated with red slip, decorated with floral motifs and intersecting circles and elongated dots.	Mature Harappan	Lakhmirwala
41	Dish	Having a flat base and an angular rim.	Mature Harappan	Lakhmirwala
42	Bowl	Having a hemispherical body and a loop handles. Decorated with black bands.	Mature Harappan	Lakhmirwala
43	Dish-on-stand	Having an out-curved rim and finished by streak burnishing (Gery ware).	Mature Harappan	Lakhmirwala

while the bi-chrome ware sherds are rare. There are two patterns of the surface decorations – a broad band painted from rim to shoulder, and, only decorated rim portion using a black band. In some specimens the former is combined with wavy lines just below the band or with a panel on the body below the shoulder with geometric designs (hatched triangles, circles and criss-cross lines). The inner surface of bowls and basins is decorated with comb-incised parallel grooves (straight/wavy/criss-cross). Main shapes in the bi-chrome pottery include small to medium vases. These were decorated with geometric or floral motifs, outlined with black colour and filled with a white pigment.

The Sothi-Siswal pottery was usually thrown on slow wheel; the rim and neck portion were finished by smoothening with rotation, whereas, the body portion was finished without rotation since striations and finger impressions of smoothening and scraping have been observed on the surface in an irregular way. Usually the pottery has uneven thickness.

The third assemblage, the classical Harappan, generally has a red surface and is wheel-turned, although handmade specimens are also present. Main shapes include perforated jars, goblets, dishes-on-stand with tall stand, 'S' shaped jars and button base vases. Both smoothening and scraping techniques were used for surface finishing; scraping or trimming with fast rotation leaves sharp and subtle striation marks on the surface. Paintings in black pigment are invariably arranged in horizontal registers on a carefully-prepared red-slipped ground. The designs are horizontal bands, dots, arches, linear and geometrical patterns, diamond or chess-board patterns, dividing the panel into a number of compartments in which human figures, birds, fish, animals and tree designs are depicted. Fish scales, loops, chain patterns, intersecting circles are also typical painted motifs.

During the exploration it was noticed that the classical Harappan pottery was lesser than the Sothi-Siswal type on the surface. Bhan (1975: 6-7) on the basis of the Mitathal excavations mentioned that between Siswal-B (Early Harapan culture) and Late Siswal (Mature Harrappan) there is no cultural break. He stated that Period IIA is characterized by the typical Harappan ceramic industry, architecture, household objects and ornaments. The Late Siswal elements, however, survived this period without any break. In his illustrations, Figure 7: 1, 6, 12, 13, 19, 20 and 21 are akin to the Early Harappan pottery but they are also visible from the early to mid-levels of the Mature Harappan period (Bhan 1975: 26: Figure 7). Similar scenario is seen at Farmana (Uesugi 2011: 168-255). Some scholars think that a few Early Harappan sites transformed into Late Harappan without adopting classical Harappan elements and were contemporary to the Mature Harappan sites (Kumar 2009: 14-15).

The fourth group of the ceramic assemblages in the region is the Late Harappan period. The term Late Harappan period (in comparison to the early and middle stages of development of the Harappan culture) implies a stage of decline and decay from the viewpoint of the cyclic concept of cultural developments. The pottery of the Late Harappan period is of medium fabric, slightly inferior in levigation to that of the classical Harappan period. It is predominantly wheel-thrown, and a tendency towards thicker and sturdier vessels is clearly discerned. It is treated with light or dull red slip and the bright slip of the classical Harappan pottery is absent. There are two types of the Late Harappan ceramic traditions in the Ghaggar Basin viz. Mitathal IIB ceramic tradition and the Bara ceramic tradition. The common shapes and designs in the Bara culture includes storage jars with collared rim and tapering shoulders, vases with flanged rims, high neck and globular body, small vases with high neck and globular body, pedestal bowls or basins, squat vases with flaring rim and ribbed shoulder, jars decorated with rustication below belly and decorated with incised designs at the shoulders, dishes-on-stands with undercut projected and highly drooping rim, bowls with carinated and concave sides. This pottery is made up of well-levigated clay. It is treated with self-slip or applied slip of dull brown colour. Mitathal IIB represents the degenerate Siswal tradtion (Dangi 2010: 388-89; Map 6.1). The area under study is a part of the Ghaggar Basin, which is dominated by the 'Bara tradition'.

The fifth and last group of the proto-historic ceramic industry in the region is the Painted Grey Ware (PGW). The PGW or grey ware is usually wheel-thrown. It is made of well-levigated clay which is almost devoid of impurity. It appears that the vessels were dried after the primary modelling and once again placed on the wheel to finish the surface modelling like scraping the base portion, trimming and burnishing. Similarly Black slipped ware was also fabricated with the help of the same technique. But its final surface treatment using black slip makes this ware different from PGW; common shapes in the Black Slipped Ware (BSW) are dishes and bowls. Associated red ware is of medium to coarse fabric and it is made of carelessly levitated clay, usually mixed with small *kankars* and husk. The main shapes of this ware include basin, bowl, vase and jar. This ware is both hand-made and thrown on slow wheel and decorated with impressed and mud appliqué designs.

Lithic Artefacts (Table 3; Fig. 8)

Sixteen lithic artefacts were collected during the course of explorations. Among these, the objects of Rohri chert out number all others. The sickle blades dominate at the Harappan sites. It is likely that the finished blades were imported from Rohri. The occurrence of chert cores and flakes suggests that the blade maker existed in the Ghaggar Basin, an area in which the raw material is not available. Besides agate, local chert, though in a small number, was used for making blades. It might have been imported either from Rajasthan or Gujarat.

Beads (Table 4; Fig. 10)

In the course of explorations a variety of beads were collected from various sites. Beads of semi-precious stones, such as carnelian, agate, jasper, lapis lazuli, steatite and terracotta were part of the jewellery, and, bead making is one of the oldest known craft. It was introduced much before the Harappan civilization (Kenoyer 1998: 160). With the development of the Harappan civilization bead making became a highly specialized craft to cater the needs of the Harappan elites, and, for export. A number of sites have yielded unfinished beads or nodules of agate and carnelian, for example Farmana (Konasukawa *et al.* 2010: 473-476), but no drill bits have so far been reported from the region.

Discussion

In the alluvial plain, no Neolithic site has been identified thus far. Some scholars think that there was a hiatus between the Stone Age cultures and the beginning of pre-Harappan cultures in the region (Kumar 2009: 7). Domali, district Kapurthala has yielded 14 celts of Neolithic traditions and Early Harappan pottery (Sharma and Sharma 1982). The findings of Domeli are very important regarding the chronology in the Punjab plains. A few ^{14}C dates from Bhirrana are from the fifth millennium BCE (Rao *et al.* 2005: 68), but no Neolithic object so far has been reported from the site. It is quite possible that early settlers of the Ghaggar Plains, the Neolithic people, used tools of wood and other perishable material.

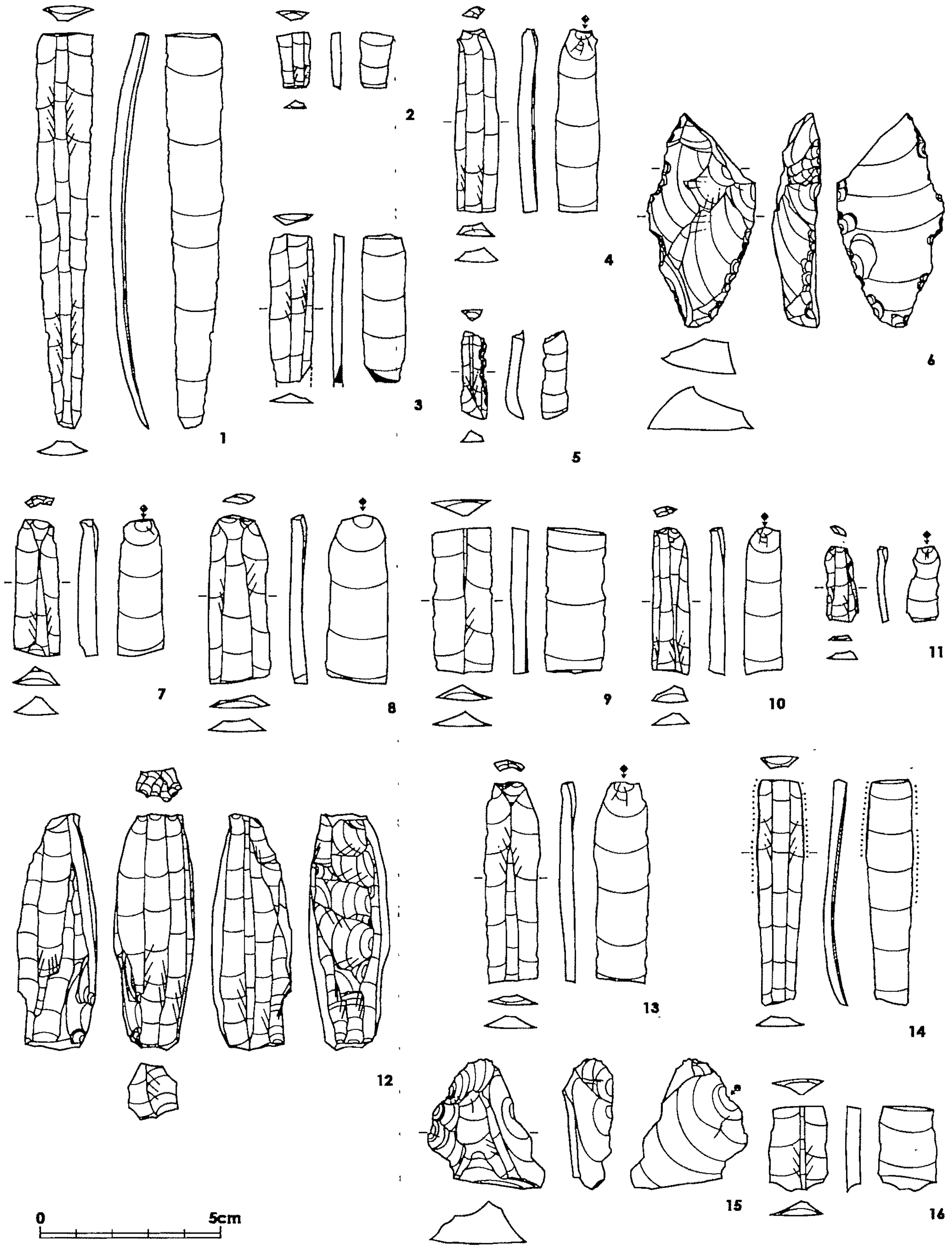
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Fig. 8: Lithic artefacts

Table 3: Details of lithic objects.

Site	Fig. 7 (no.)	Material	Colour	Condition	Blank	Dorsal	length (cm)	width (cm)	thickness (cm)	weight (g)
Banawali	1	Rohri chert	light brown	broken/distal	secondary blade	parallel	10.72	1.58	0.36	6.9
Banawali	2	local chert	dark red	broken/medial	secondary bladelet	parallel	1.49	0.89	0.21	0.4
Bhirrana	3	Rohri chert	gray	broken/medial	secondary blade	parallel	3.98	1.20	0.28	1.7
Bhirrana	4	Rohri chert	brown	broken/proximal	secondary blade	parallel	4.92	1.24	0.40	3.2
Bhirrana	5	local chert	dark brown	broken/distal	secondary bladelet	parallel	2.31	0.75	0.32	0.7
Bhirrana	6	Rohri chert	dark brown	complete	secondary flake		5.79	3.05	1.17	16.9
Dhalewan	7	Rohri chert	gray	broken/proximal	secondary blade	parallel	3.67	1.25	0.44	2.5
Kunal	8	Rohri chert	gray	broken/proximal	secondary blade	parallel	4.54	1.69	0.43	4.4
Kunal	9	Rohri chert	light brown	broken/medial	secondary blade	parallel	4.00	1.61	0.51	3.5
Kunal	10	Rohri chert	dark brown	broken/proximal	secondary blade	parallel	3.97	1.06	0.41	2.2
Kunal	11	local chert	dark red	broken/proximal	secondary bladelet	parallel	2.02	0.87	0.23	0.6
Kunal	12	agate	translucent white	complete	-		6.44	2.26	2.21	39.4
Lakhmirwala	13	Rohri chert	light brown	broken/proximal	secondary blade	parallel	5.43	1.50	0.35	3.0
Narenderpura	14	Rohri chert	gray	broken/medial	secondary blade	parallel	6.18	1.30	0.33	3.4
Lakhmirwala	15	Rohri chert	brown	complete	secondary flake		3.53	2.69	1.33	10.7
Talwara	16	Rohri chert	light brown	broken/medial	secondary blade	parallel	2.28	1.60	0.42	1.9

Table 4: Details of beads discovered from various sites

Site	Fig. 8 (no)	Material	Colour	Category	Shape	length (cm)	width (cm)	thickness (cm)	weight (g)
Banawali	1	agate	translucent red- translucent white	bead	long barrel elliptical	1.16	1.04	0.58	1.0
Banawali	2	carnelian	translucent orange	bead	triangular	0.64	0.85	0.64	0.3
Bhirrana	3	carnelian	translucent red	etched bead	elliptical	0.52	1.05	0.48	0.4
Bhirrana	4	Lapis lazuli	dark blue	bead	long cylindrical	0.79	0.32	0.31	0.1
Bhirrana	5	carnelian	translucent red	bead	quadrilateral	0.45	0.60	0.60	0.2
Bhirrana	6	carnelian	translucent red	bead	hexagonal	0.52	0.67	0.72	0.3
Bir Khurd	7	agate	translucent yellow- translucent white	bead	long barrel elliptical	2.02	1.23	0.60	2.1
Dhalewan	8	carnelian	translucent red	bead	long bicone	1.20	0.81	0.82	1.0
Gullarwala	9	agate	translucent yellow- translucent white	bead	short cylindrical	0.56	0.39	0.38	0.1
Gurni Kalan	10	faience	light blue	bead	long cylindrical	1.14	0.40	0.40	0.2
Gurni Kalan	11	faience	light blue	bead	long barrel	0.92	0.64	0.65	0.4
Kunal	12	carnelian	translucent red	bead	long bicone	0.89	0.64	0.64	0.6
Lakhmirwala	13	carnelian	translucent red	bead	long barrel	0.94	0.52	0.51	0.4
Narenderpura	14	carnelian	translucent orange	bead	long cylindrical	0.75	0.51	0.51	0.3
Talwara	15	carnelian	translucent red	bead	long barrel	0.97	0.60	0.55	0.6

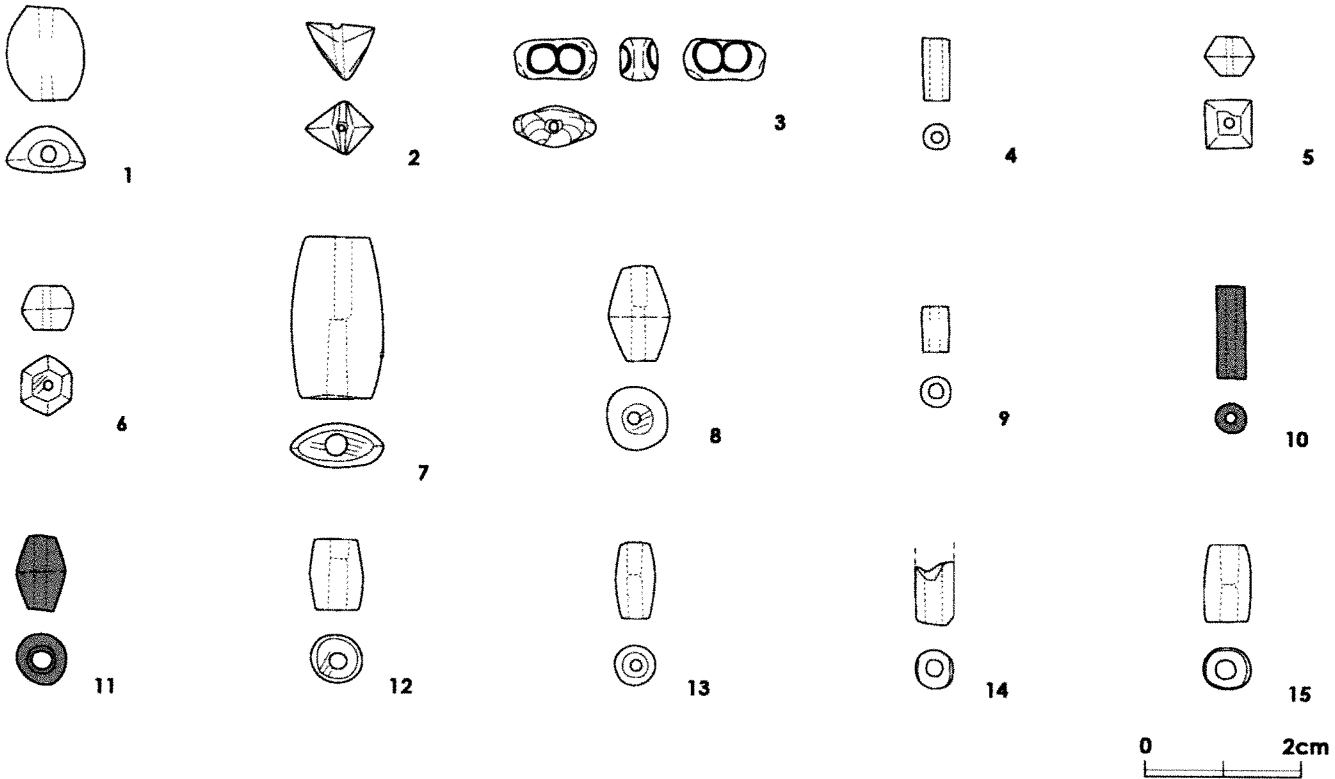

Fig. 9: Beads of semi-precious stones and faience

Prior to the 1970s generally, terms such as 'Harappan' and 'non-Harappan' were based on ceramic assemblages. When deposit or pottery was discovered underneath Harappan remains, it was regarded as the 'Pre-Harappan' because the Early Harappan phase was either uncertain or was then not recognized.

Khan (1968) pointed out some resemblance in the material evidence found at Kot Diji and those of the 'Mature Harappan' culture. The early occupation lying below the Mature Harappan deposit at Kalibangan, Banawali, Siswal and Sothi was earlier termed as 'Pre-Harappan' and later the excavator of Kalibangan addressed it as Early Harappan. The term 'Pre-Harappan itself is ambiguous because it creates the impression of chronological gap between the 'Pre-Harappan' period and the 'Mature Harappan'. Mughal (1970: 6) was the first to use the term 'Early Harappan' instead of 'Pre-Harappan'. Here the term 'Early Harappan' stands to define the culture which flourished in the study region during the first half of the 3rd millennium BCE, whereas the term 'Ghaggar-Hakra' stands for the culture which developed in the upper Ghaggar Basin in the 4th millennium BCE (Dangi and Kumar 2010) before Early Harappan culture. The Ghaggar-Hakra phase of Upper Ghaggar Basin is contemporary to the Ravi phase at Harappa. Earlier this culture was labelled as the Hakra Culture (Khatri and Acharya 1995: 84-86; Rao *et al.* 2005: 60-68*)* and Regional-Hakra (Shinde *et al.* 2009*)*. But the term Hakra or Regional Hakra is not appropriate for the upper Ghaggar Basin because there are a lot differences in the material culture recovered from the Cholistan region and Haryana (Upper Ghaggar Basin). The Ghaggar-Hakra repertoire at Kunal and Bhirrana occurs in a separate horizon and indicates a very early village development in the region. In the area under the present study, there are six sites which have yielded pottery of this Ghaggar-Hakra tradition. Earlier this culture was known through the excavations only at Kunal and Bhirrana but the present study brought to light four more sites.

Early Harappan

This cultural phase succeeds the Ghaggar-Hakra culture in the region and is represented by the characteristic Sothi-Siswal ceramics, with the influence of Kot Diji elements. On the basis of ^{14}C dates from Kalibangan and Bhirrana this cultural phase can be assigned to the early 3rd millennium

BCE. The Sothi-Siswal culture is a regional variant of the Early Harappan culture in the upper and middle Ghaggar Basin, although we are getting some foreign elements in the ceramics like surface treatments and decorations akin to the pottery in western Punjab. This might be due to the contacts and interactions between these regions. The excavation at Bhirrana showed that there was a continuity of the Sothi-Siswal elements (especially ceramics) in the succeeding Mature Harappan phase (Rao 2005: 61). Also at Banawali, a similar scenario was noticed (Bisht 1982: 116). Of the explored twenty seven sites, six sites of the Ghaggar-Hakra period were occupied by the Early Harappans. The rest were laid afresh. Most of these sites have multi-cultural deposits.

Mature Harappan period

The cultural phase that follows the Early Harappan period in this region represents the urban Harappan civilization. A total of seven sites related to this phase yielded classical Harappan pottery and antiquities. It is quite strange that the number of sites during the urban phase decreased. It is possible that some of the Early Harappan villages maintained their character during the Mature Harappan phase and perhaps therefore, are devoid of classical Harappan elements. The quantity of classical Harappan pottery is much less than other local pottery. It appears that ceramic tradition of the Sothi-Siswal culture continued throughout the Mature Harappan phase. Mitathal also yielded the similar evidence as a good number of pot sherds have affinity with the regional Early Harappan culture in Period IIA (Suraj Bhan 1975: 23). He found that there is no cultural break between Siswal-B (Early Harapan culture) and Late Siswal (Mature Harrappan).

It was noticed that the Harappan and non-Harappan types (Sothi-Siswal traditions) were found throughout the cultural phases (Uesugi 2011: 85-86). During the exploration the Mature Harappan sites were identified on the basis of typical Harappan pottery, such as button-base goblets, perforated jars, dish-on-stands with long stems and flaring rims. In other words, there is a possibility that there were some contemporary rural Harappan settlements which did not adopt the classical Harappan elements. Manmohan Kumar (2009) also concluded in the same way.

During the course of the exploration the author came across a Harappan seal (Kumar and Dangi 207: 135-136) which is in the possession of a villager of Bhirrana (Fig. 10). This square steatite seal measures 2.4 x 2.4 cm and has a perforated knob at the back. The seal has a caparisoned unicorn standing facing right with his head raised. It is distinguished by a long tail touching the ground, a long horn with a number of barbs and excited ear. The eyes and mouth of the animal are quite conspicuous, and a low dewlap is marked by incised lines. There are three signs of the Harappan script above the unicorn. The middle one indicates the right to left direction of writing as there is an overlap of triangle signs from right to left. Similarly, the slant of the last sign also points to the right to left writing manner. The boss on the back side of the seal is quite broad and not well finished.

Late Harappan Period

Eleven sites yielded the remains of this cultural phase. The classical Harappan shapes like goblets, beakers, perforated jars, dishes-on-stand with long stems and bowls with nail-headed rims were out of use. The common pottery types are dishes-on-stands with ribbed junctions, dishes-on-stands with broad and short stands, vases with projected undercut rims, jars with wide and narrow mouths, globular vases with flanged rims and flasks treated with fine red slip. Out of total 11 Late Harappan sites 5 were occupied for the first time. As we move towards east of the study area, the density of the Late Harappan sites increases. Present-day Jind, Kurukshetra, Kaithal, Patiala, Sangurur districts were thickly populated during this period.

PGW Period

The exploration yielded 16 PGW sites. The area under the present study has only one site which yielded the remains of both the Late Harappan and the PGW phase. Out of total 16 sites, 10 sites were occupied for the first time. Period IA at Bhagwanpura is represented by the Late Harappan people, while Period IB is distinguished by the continuous occupation of the Late Harappan people and the advent of PGW using people (Joshi 1993). Similar evidence was also reported from Madina (Kumar *et al.* 2009). Here the excavator does not claim an overlap, but writes that '... an important result of the excavation is the discovery of the Late Harappan traits during the PGW period' (Kumar *et al.* 2009: 114). The coexistence of two different social groups

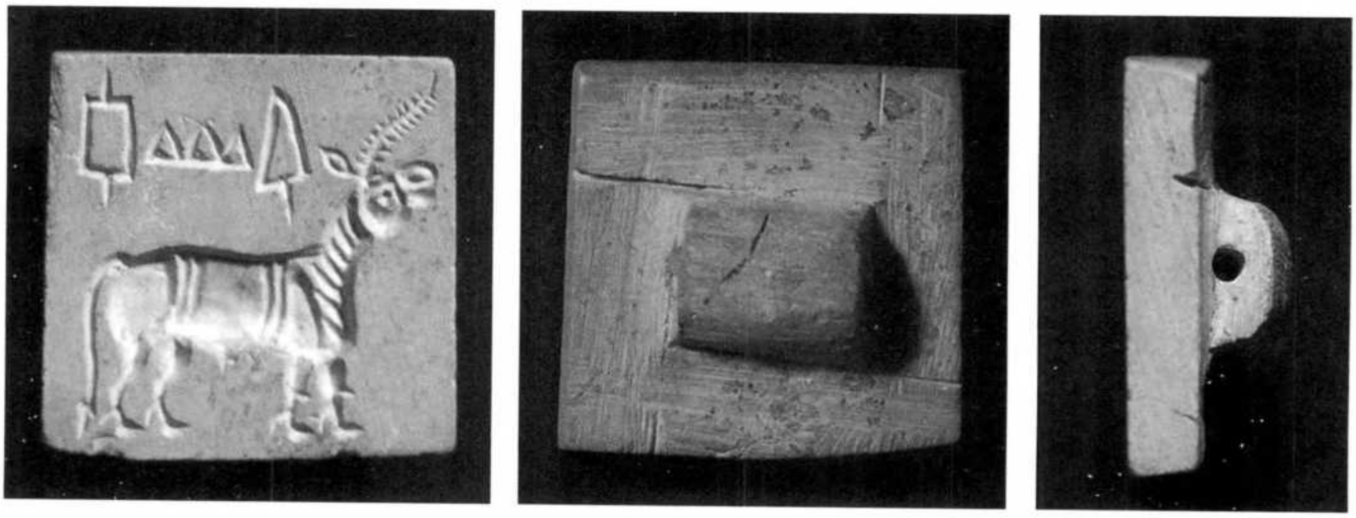

Fig. 10: A Harappan seal, from Bhirrana

tends to bridge the gap between the Late Harappan and PGW using peoples.

Historical and Medieval period

Twenty-three Medieval sites were explored. During the Historical period the area was thickly populated as it is indicated by the discovery of 41 sites. Most of the Historical sites have pottery of Ranghmahal tradition. During the Medieval times Fatehabad was the major administrative centre and it was a part of Hissar-Feroza Sarkar (Sarkar 1978: 300-301).

Conclusion

An extensive village-to-village survey in the region helped us to correct some of the earlier recording of sites and their size e.g. Lakhmirwala, Gurnikalan-1 (district Mansa, Punjab) and so on. During the survey it was noticed that most of the archaeological sites are either converted into the agriculture fields or the soil is removed for making roads, canals and domestic structures. The situation is very grim because in a few years it will be very difficult for the archaeologists to spot any site for excavation. Even today it is very hard to spot an intact mound. But still some sites viz. Lakhmirwala, Gurnikalan, Burj, have rich archaeological potential and if excavated or declared protected they can throw welcome light on the history and culture of the region. Otherwise like other sites these are doomed to vanish without any trace and the future generations shall be deprived of a vast archaeological heritage.

Acknowledgements

I acknowledge many individuals who enlightened me during my research work such as Profs. Manmohan Kumar, V.S. Shinde, Dr. R.S. Bisht, Late Prof. Suraj Bhan, Shri G.B. Sharma and Dr. J.S Kharakwal. for their support, valuable suggestions and encouragement. I am thankful to my wife Bhuneshwari for providing me geographical data of the region. I owe sincere thanks to Dr. Akinori Uesugi, for his support in many ways. Mr. Hitoshi Endo also provided help in recording cultural materials that were collected from this region. I am grateful to my friends Nishand Dhankar, Manujeet, Sudhir, Manjeet and Sandeep Malik who provided me constant help during the field survey.

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Table 5: Comparative chronology for the study area

		W. Punjab	**Sindh**		**Ghaggar Valley**			**Sirhind cho**		**Chautang Valley**	
		Harappa	**Amri**	**Baror**	**Bhirrana**	**Banawali**	**Burj**	**Dhalewan**	**Girawad**	**Rakhigarhi**	**Madina**
600 BC	**PGW**						Period II				Phase VIII Phase VII Phase VI Phase V Phase IV
1200 BC	**Overlap of Late Harappan/ PGW**										Phase III Phase II Phase I
1500 BC	**Late Harappan**	Period V Period IV	Period IIID			Period III					
1900 BC	**Mature Harappan**	Period IIIC Period IIIB Period IIIA	Period IIIC Period IIIB Period IIIA	Period III	Period IIB Period IIA	Period II		Period II		Period II	
2600 BC	**Early Harappan**	Period II Period I	Period IIB Period IIA Period ID Period IC	Period II	Period IB	Period I	Period I	Period I	Period I	Period IB	
3000 BC	**Pre-Harappan**		Period IB Period IA	Period I	Period IA					Period IA	
3500 BC											

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R.N. Singh *et al*, *Man and Environment* XXXVI(2): 88-106 [2011].
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New Insights into Settlement along the Ghaggar and its Hinterland: a Preliminary Report on the Ghaggar Hinterland Survey 2010

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Abstract

This paper presents a report of the *Ghaggar Hinterland Survey*, a focussed village-to-village survey of the hinterland of the middle course of the Ghaggar River (particularly Fatehabad District, Haryana and Mansa District, Punjab). During November and December 2010, a total of 182 sites were visited. A sizable proportion of the visited sites were previously unknown, including sites of all periods. The results of this survey serve to reiterate a number of problems with the existing site distribution data sets for the region, and, have important ramifications for our understanding of the dynamics of settlement in Haryana and the southern Punjab throughout proto- and early history. This survey also helps make an important contribution to our understanding of the rise of cities in western India during the periods of the Indus and Early Historic urbanisation, and, the role that proximity to rivers and water sources played in these processes.

Introduction

The plains of northwest India (Fig. 1) span the critical zone between the Indus and Ganga hydrological systems and make up parts of the modern states of Haryana, Punjab and Rajasthan. This is perhaps the most important region in the subcontinent for understanding the major series of cultural transformations that are marked by the rise and fall of the urban centres of the Indus Civilisation during the third and second millennia B.C., and the subsequent reappearance of urban centres in the Ganga Valley during the first millennium B.C. The plains of the northwest have been subjected to numerous archaeological surveys that have documented hundreds of archaeological sites dating to periods spanning from the beginnings of settled village life in the third millennium B.C. up to the Historic and Medieval periods. Although, there have been several attempts to synthesise these survey results (e.g. Joshi *et al.* 1984; Possehl 1999; Kumar 2009) and discuss the entire chronological span of occupation in the region (e.g. Chakrabarti and Saini 2009), nevertheless most of the focus has been on the evidence for protohistoric settlement patterns. Recent reconnaissance and survey work by the *Land, Water and Settlement Project* has, however, shown that there are a number of significant limitations to the existing survey data that are not commonly acknowledged, and emphasises that new surveys using updated methods are critical for understanding the archaeology of northwest India (Singh *et al.* 2008, 2010).

The *Land, Water and Settlement Project* is a multidisciplinary collaborative venture comprised of researchers from Banaras Hindu University (BHU), the University of Cambridge, Imperial College London, the Indian Institute of Technology (Kanpur), the University of Oxford, and the Uttar Pradesh State Archaeology Department. An initial reconnaissance survey conducted by the project in 2008 aimed to establish the relationship between archaeological sites and their geographical and landscape context in two primary zones: the area northeast and east of New Delhi in western UP; and the central Haryana Plains, between Hisar and Karnal. The results of this reconnaissance have been published earlier (Singh *et al.* 2008, 2010). It is useful to reiterate

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Received : 01-06-2011
Revised : 01-09-2011
Accepted : 12-11-2011

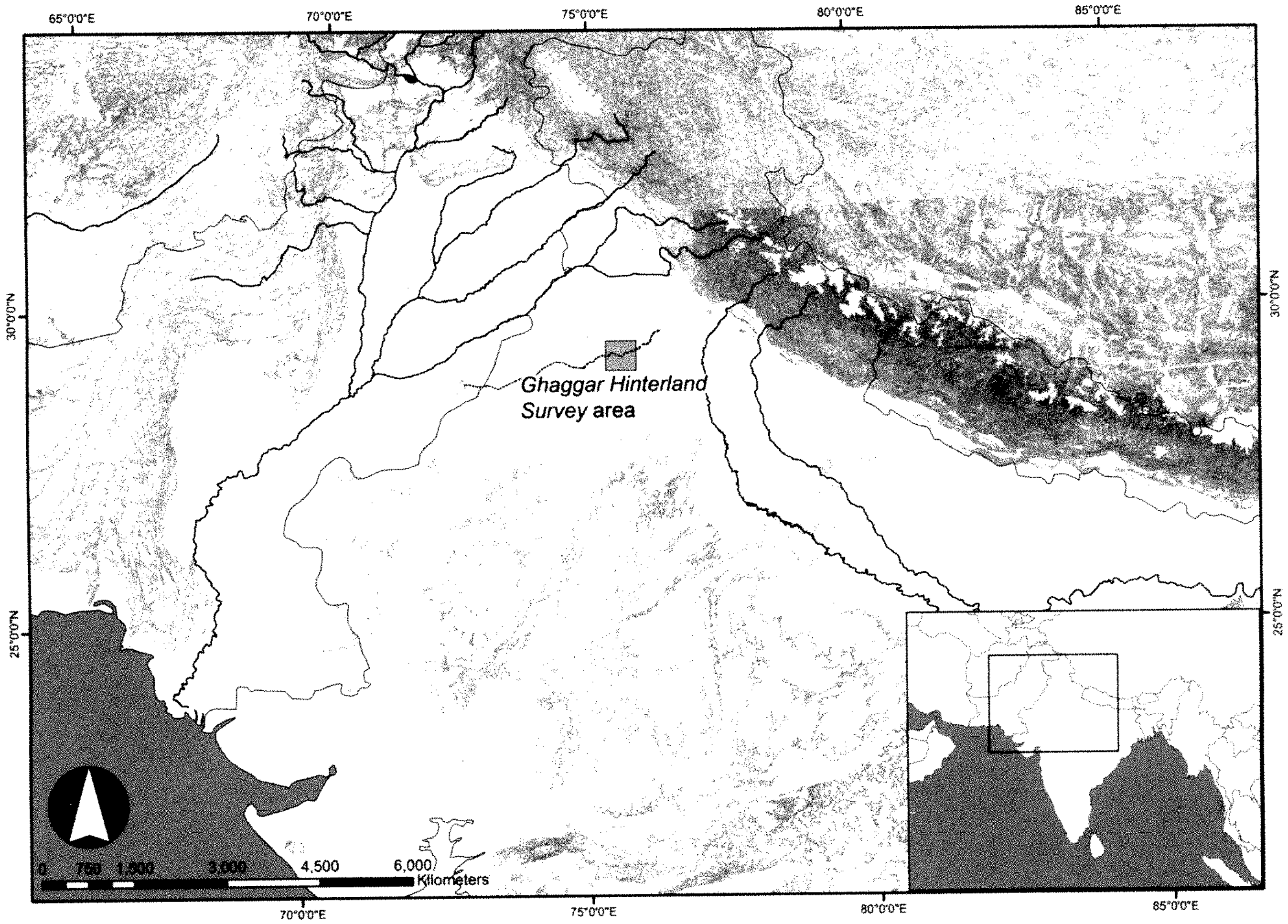


Fig. 1: Map of northwest South Asia showing the location of the *Ghaggar Hinterland Survey* study area

here the key elements of these findings, as they provide critical context for our understanding of the location and distribution of proto-historic and historic settlements, the preservation of those settlements, and the geographical landscapes within which those settlements lie.

Firstly, it is clear (and needs to be acknowledged) that there are significant problems with the quality of the existing survey data for northwest India (Singh *et al.* 2008, 2010). Very few surveys have seen the use of GPS equipment to locate sites accurately. It has been far more common for sites to be located with a latitude/longitude (easting/northing) format that only records degrees and minutes, and by recording the name and using the co-ordinates of the nearest village rather than the precise location of the site. This produces an inherent vagary in the data. Checking existing data points on satellite imagery and ground truthing by revisiting sites and recording their location with a GPS has shown that site locations typically have errors of between several hundred metres to several kilometres. Also, when several sites are located close to one village, the sites are typically given separate numbers, but one geographical co-ordinate is recorded, making it impossible to differentiate sites (e.g. Masudpur I-IV; Joshi *et al.* 1984; Possehl 1999). Furthermore, when more than one survey has been carried out in a particular area there are often differences in the locations given for particular sites and variant spellings are also common (e.g. Dalelwala or Dalliwala, Karanpur or Karapura) in many instances, making it difficult to establish which sites are being referred ts (Singh *et al.* 2008, 2010).

Secondly, there have been few attempts to consider the protohistoric and/or historic landscape itself as a basis for its analysis, which means that the available data are skewed (Singh *et al.* 2008, 2010). A review of the published survey record and the synthetic papers that use these data indicate that the majority of the archaeological surveys that have been carried out in different parts of Haryana have largely been conducted by M.Phil. and Ph.D. students from Kurukshetra University and M.D. University in Rohtak (summarised in Possehl 1999; Kumar 2009; Chakrabarti and Saini 2009). This has meant that surveys have generally focussed on individual tehsils and/or districts, as these are deemed to be suitably sized areas for student research projects. While this need not be problematic, it iso clear from the published distribution maps that some areas have been surveyed intensively, which produces high densities of sites in certain areas (e.g. Dangi 2009a, 2009b), and implies that adjacent areas have fewer sites. However, the unacknowledged reality is that many of these adjacent areas have usually been surveyed in less detail or not at all. In addition, the plains of Haryana and western UP are predominantly flat, and areas of sharp elevation are typically either sand dunes or archaeological sites. A number of modern villages appear to have been built on significantly elevated ground, and this makes it likely that many of the modern villages situated on elevations are actually built on top of archaeological sites. This observation has particular significance when it is noted that many of these elevated villages are not included in the lists of known archaeological sites. Large numbers of sites are also under threat from levelling and soil removal (Singh *et al.* 2008, 2010).

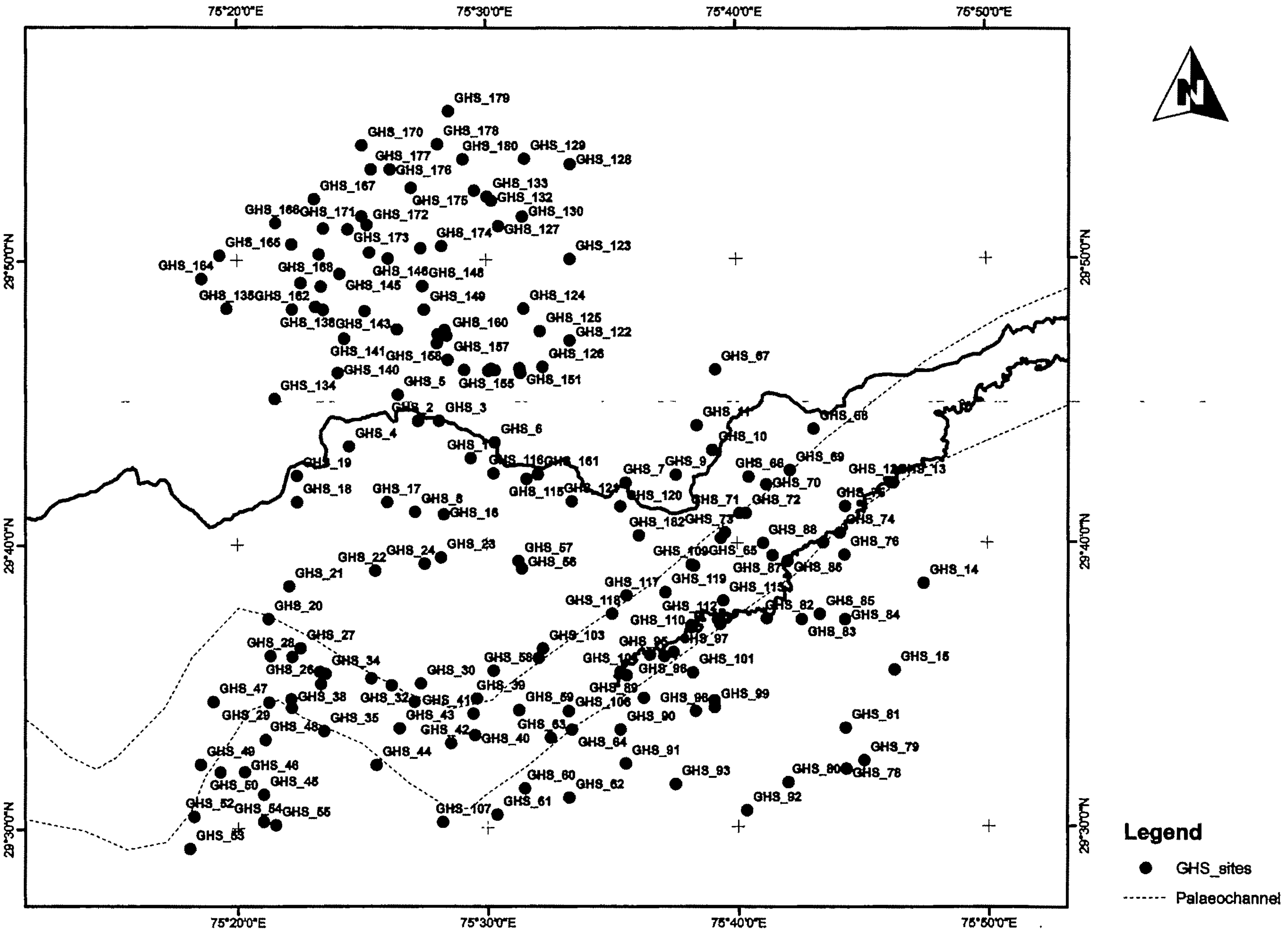
Thirdly, the presumed correlation between protohistoric archaeological sites and various large-scale hydrological features that cross the plains of northwest India is likely to have been overstated (Singh *et al.* 2008). There has been considerable speculation about the relationship between protohistoric archaeological sites and a range of watercourses. These include modern ephemeral channels, such as the Ghaggar, Hakra, Naiwal, Sarsuti, Markanda, and Chautang Rivers, and what appear to be one or more ancient palaeochannels that were first recognized on the ground as wide channels demarcated by sand dunes (e.g. C.F. Oldham 1874, 1893; R.D. Oldham 1886; Stein 1940), and whose courses have since been reconstructed on the basis of satellite imagery (e.g. Ghose *et al.* 1979; Yashpal *et al.* 1980). Several publications have asserted that there are substantial numbes of the Indus period sites that lie along the course of this relict river (e.g. Valdiya 2002; Lal 2002; Bhadra *et al.* 2009; Danino 2010). The *Land, Water and Settlement* reconnaissance survey of 2008 and an re-assessment of the data compiled by Kumar (2009) has demonstrated that a large number of sites are located at some distance from the ephemeral water courses and palaeochannels, while others are actually located on the banks of ephemeral nullahs rather than rivers (Singh *et al.* 2008).

The widespread and inconsistent errors in the co-ordinates for sites, the likelihood that numerous sites are missing from the current lists, and, the fact that potentially unwarranted focus is given to specific landscape features means that much of the existing survey data and the derived interpretations are problematic and heavily biased. These biases have major ramifications for our understanding of the nature of the protohistoric and/or historic landscape, as any attempts to assess the geographical context of the prehistoric archaeological sites using the existing data set of prehistoric site locations are thus likely to be fundamentally flawed. The limitations of the existing data are of critical importance when it comes to interpreting the landscape contexts of Indus and later sites, particularly the relationship between archaeological sites and the palaeochannels that cross the plain.

With an awareness of the limitations of the existing survey data, the *Land, Water and Settlement Project* conducted a detailed survey in the hinterland of Rakhigarhi in 2009 (*Rakhigarhi Hinterland Survey* or RHS). This survey set out to accurately locate sites within a 15 km radius of the major Indus urban centre in northwest India, and, thereby characterise temporal and spatial change in settlement distribution in the hinterland of this major Indus Civilisation centre (Singh *et al.* 2010). The *Land, Water and Settlement Project* expanded its survey work in November-December 2010 with a systematic village-to-village survey that encompassed a large area of the hinterland of the middle course of the Ghaggar River, which is defined here as the part that traverses Fatehabad District, Haryana and Mansa District, Punjab (Figs. 1 and 2).

The archaeology of the middle course of the Ghaggar River

Archaeologically, the middle course of the Ghaggar River is known primarily thanks to the excavations carried out at the site of Banawali by the Archaeological Survey of India between 1974-7 and 1983-4 under the direction of R.S. Bisht (1982; *IAR* 1983-4: 2-9). These excavations demonstrated that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GHS_176
GHS_167
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Fig. 2: Map showing the distribution of sites within Ghaggar Hinterland Survey study area. The course of the modern ephemeral Ghaggar is shown as a solid line across the centre. The course of the Rangoi nullah is shown as a solid line below. The purported course of the Ghaggar palaeochannel is shown in dotted lines

Banawali was an important regional centre (c. 15 ha in size) with extensive evidence for fortifications, planning, and water management. The site appears to have been occupied during the pre-Indus, Indus and post-Indus phases (Bisht 1982; *IAR* 1983-4: 2-9). Excavations were subsequently carried out at the small village sized site of Kunal (c. 1 ha) by the Haryana Department of Archaeology (*IAR* 1985-6: 23-5), and more recently the ASI carried out excavations at the medium-large village sized site of Bhirrana (c. 4 ha) for three seasons (2003-2006) under the direction of the late L.S. Rao (Rao *et al.* 2004, 2005, 2006). All three of the above sites lie to the south of the modern Ghaggar, and all three excavations saw an intense focus on Indus period or related occupation. There were previously only a relatively small number of other archaeological sites recorded on this part of the plain, including Burj, Chimun, Gularwala and Ratta Theh (Suraj Bhan 1975; Joshi *et al.* 1984; Possehl 1999; see Singh *et al.* 2008). It is notable that most of these sites were initially recorded by Suraj Bhan (1975: 116ff.) in his surveys of the Sutlej-Yamuna Basin, which focussed on what he referred to as the Sarawati Valley and the dry bed of the Saraswati. This particular part of the middle course of the Ghaggar does not appear to have been surveyed subsequently (see maps in Kumar 2009). To the north of the modern Ghaggar there is a larger concentration of settlement sites (Joshi *et al.* 1984: 520; Chakrabarti 1995: 109) that now lie within the bounds of Mansa District, Punjab, which was a part of Bhatinda District until 1992. This concentration is particularly interesting as it is purported to include several >100 ha Indus period sites in close proximity to each other, including Lakhmirwala, which was recorded as being 225 ha in size (Joshi *et al.* 1984: 520; Chakrabarti 1995: 109; Possehl 1999: 788), implying that it was considerably larger than Rakhigarhi. The existing survey data for the region on either side of the middle course of the Ghaggar thus appears to be the product of surveys carried out along the apparent course of the Ghaggar/Saraswati paleochannel by Suraj Bhan, and a focussed survey conducted within the bounds of the old Bhatinda District, Punjab. Knowledge of the Historic period occupation on both sides of the modern Ghaggar in this region is exceedingly minimal.

Although it lies to the south of the modern Ghaggar, plans of Banawali typically indicate that the site lies immediately adjacent and to the north of the dry bed of the Saraswati River, and it is typically described in these terms (e.g. *IAR* 1983-1984: 25, Fig. 4). The site of Bhirrana is similarly described as overlooking the left bank of the dry Saraswati (e.g Rao *et al.* 2004: 20). Awareness of the course of a large palaeochannel in this region is largely thanks to the publication of maps by Yashpal *et al.* (1980) that showed the apparent course of a large water course as visible on LANDSAT satellite imagery and drew correlations with the location of archaeological sites. It is, however, important to point out that today, there is no large channel clearly visible on the ground, and it is not marked on British period 1 inch to 1 mile scale maps from the early decades of the twentieth century. The British period maps do, however, show areas of shallow depressions, and these broadly follow the alignment of the linear feature that was identified by Yashpal *et al.* (1980).

The Ghaggar Hinterland Survey

Rather than being defined on the bascs of administrative boundaries, the limits of the survey area were delimited in such a way as to include the hinterlands of the excavated Indus Civilisation settlements at Banawali, Bhirrana and Kunal, and also the sites known from earlier surveys elsewhere in Fatehabad District, Haryana and Mansa District, Punjab (Fig. 2). Full-coverage of the survey area was attempted in the hope of locating sites dating to all periods. A key objective of this survey was to revisit all known Indus period sites in the study area in order to establish their precise location and size, and to determine precisely in which periods and sub-periods they were occupied. It was also assumed that there would be a significant number of previously unidentified sites in the region. Furthermore, it was hoped that the precise relationship between the archaeological sites and the modern and palaeo-water courses would be demonstrated, thereby providing a clear impression of the relationship between settlement, water resources and the landscape. The results of this survey are still being processed. It is, however, possible to present the basic data and venture some tentative conclusions based on the spatial and temporal distribution of these sites. It has also been possible to comment on their landscape context as it can be reconstructed using British period 1" to 1 mile maps, more recent satellite imagery, and observations made on the ground.

Table 1: List of sites recorded during the Ghaggar Hinterland Survey. Site locations established using a Garmin GPS.

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
1	Alawalwas	Alawalwas	75	29.37	29	43.04	202	-	-	-	-	-	-	1	
2	Kalotha I	Kalotha	75	27.27	29	44.36	212	-	-	-	-	-	-	1	
3	Kalotha II	Kalotha	75	28.11	29	44.36	206	-	-	-	-	-	-	1	
4	Malwala	Malwala	75	24.51	29	43.47	203	1	-	-	-	-	-	-	
5	Mohammedki	Mohammedki	75	26.47	29	45.28	214	-	-	-	-	-	1	-	
6	Baliala	Baliala	75	30.33	29	43.6	217	-	-	-	-	-	1	-	Kumar 2009
7	Kamana	Kamana	75	35.56	29	42.16	216	-	-	-	-	-	1	-	
8	Kawalgarh I	Kawalgarh	75	27.14	29	41.16	211	-	-	-	1	-	-	-	
9	Kawalgarh II	Kawalgarh	75	37.57	29	42.43	213	-	-	-	-	-	1	-	
10	Bhawanikhẹra	Bhawanikhera	75	39.04	29	43.3	213	-	-	-	1	-	-	-	Possehl 1999; Kumar 2009
11	Mahamra	Mahamra	75	38.41	29	44.17	220	-	-	-	-	-	-	1	
12	Gularwala	Gularwala	75	46.25	29	42.12	211	1	1	-	-	-	1	-	Possehl 1999; Kumar 2009
13	Dher	Dher	75	46.18	29	42.12	212	-	-	-	-	-	-	1	
14	Bhodi	Bhodi	75	47.45	29	38.58	227	-	-	-	-	-	1	1	
15	Bawan	Bawan	75	46.27	29	35.53	206	-	-	-	1	-	1	-	Possehl 1999; Kumar 2009
16	Dadupur	Dadupur	75	28.29	29	41.07	204	-	-	-	-	-	1	-	
17	Hukmawali	Hukmawali	75	26.03	29	41.51	202	-	-	-	-	-	-	1	
18	Gandha	Gandha	75	22.42	29	41.51	205	-	-	-	-	-	-	1	Kumar 2009
19	Saharana	Saharana	75	22.42	29	42.44	202	-	-	-	-	-	-	1	
20	Bharanwali	Bharanwali	75	21.25	29	37.4	214	-	-	-	-	-	-	1	
21	Khundan	Khundan	75	22.1	29	38.55	197	-	-	-	-	-	-	1	Chakrabarti and Saini 2009
22	Nagpur	Nagpur	75	25.54	29	39.1	196	-	-	-	-	-	-	1	
23	Nimdi	Nimdi	75	28.17	29	39.56	178	-	-	-	-	-	-	1	
24	Haroli	Haroli	75	27.51	29	39.34	201	-	-	-	-	-	-	1	
25	Banawali	Banawali Sottar	75	23.32	29	35 54	209	1	1	1	-	-	-	-	Possehl 1999; Kumar 2009
26	Ratta Tibba I	Ratta Tibba	75	22.22	29	36.07	200	-	-	-	-	-	-	1	

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHIs	Med	Previous reporting
27	Manakpur	Manakpur	75	22.55	29	36.37	201	-	-	-	-	-	-	1	Chakrabarti and Saini 2009
28	Ratta Tibba II	Ratta Tibba	75	21.33	29	36.1	197	-	-	-	1	-	1	1	
29	Ali Sadar I	Ali Sadar	75	21.27	29	34.46	200	-	-	-	-	-	1	1	
30	Jandwala	Jandwala	75	27.35	29	35.12	202	-	-	-	-	-	1	-	
31	Mallhar	Mallhar	75	27.1	29	34.48	202	-	-	-	-	-	-	1	Kumar 2009
32	Chugha Ali	Chugha Ali	75	26.19	29	35.06	202	-	-	-	-	-	1	-	
33	Karian Ali	Karian Ali	75	25.37	29	35.31	202	-	-	-	-	-	-	1	
34	Musa Ali	Musa Ali	75	23.54	29	35.47	199	-	-	-	-	-	1	1	
35	Hijarawan Kala I	Hijarawan Kala	75	23.48	29	33.45	201	-	-	-	-	-	-	1	
36	Hijarawan Kala II	Hijarawan Kala	75	23.36	29	35.11	204	-	-	-	-	-	1	1	
37	Hijarawan Khurd I	Hijarawan Khurd	75	22.17	29	34.58	195	-	-	-	-	-	1	1	
38	Hijarawan Khurd II	Hijarawan Khurd	75	22.19	29	34.27	201	-	-	-	-	-	1	-	
39	Ayalki I	Ayalki	75	29.58	29	34.58	196	-	-	-	-	-	1	-	
40	Ayalki II	Ayalki	75	29.51	29	33.29	203	-	-	-	-	-	-	1	
41	Ayalki III	Ayalki	75	29.44	29	34.05	205	-	-	-	-	-	-	1	
42	Dhir (Zafarwal)	Dhir (Zafarwal)	75	28.55	29	33.01	208	-	-	-	-	-	-	1	
43	Dhani Thoba	Dhani Thoba	75	26.5	29	33.54	207	-	-	-	-	-	-	1	
44	Khan Muhammad	Khan Muhammad	75	25.57	29	32.25	209	-	-	-	-	-	1	1	
45	Daryapur I	Daryapur	75	21.05	29	31.21	204	-	-	-	-	-	-	1	
46	Daryapur II	Daryapur	75	20.28	29	32.01	208	-	-	-	-	-	-	1	
47	Ali Sadar II	Ali Sadar	75	19.02	29	34.49	202	-	-	-	1	-	1	1	
48	Haripura	Haripura	75	21.12	29	33.14	207	-	-	-	-	-	1	-	
49	Karnauli I	Karnauli	75	18.51	29	32.28	222	-	-	-	-	-	1	1	
50	Karnauli II	Karnauli	75	19.3	29	32.01	205	-	-	-	-	-	1	-	
51	Gehla Khera I	Gehla Khera	75	18.59	29	21.26	210	-	-	-	-	-	-	1	
52	Gehla Khera II	Gehla Khera	75	18.24	29	30.45	206	-	-	-	-	-	-	1	
53	Gehla Khera III	Gehla Khera	75	18.07	29	29.32	196	-	-	-	-	-	-	1	
54	Sahidanwali	Sahidanwali	75	21.04	29	30.26	194	-	-	-	-	-	-	1	
55	Kharaiti Khera	Kharaiti Khera	75	21.54	29	30.14	199	-	-	-	-	-	-	1	Kumar 2009
56	Ratta Khera I	Ratta Khera	75	31.4	29	39.15	203	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
57	Ratta Khera II	Ratta Khera	75	31.26	29	39.42	208	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009
58	Barota	Barota	75	30.26	29	35.56	204	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009
59	Rajabad	Rajabad	75	31.27	29	34.16	211	-	-	-	-	-	-	1	
60	Majara	Majara	75	31.49	29	31.41	210	-	-	-	-	-	1	1	Kumar 2009
61	Bisla	Bisla	75	30.38	29	30.49	203	-	-	-	-	-	1	-	
62	Jhalnia	Jhalnia	75	33.27	29	31.08	207	-	-	-	-	-	-	1	
63	Bhirrana I	Bhirrana	75	32.53	29	33.19	204	1	1	-	-	-	-	1	Possehl 1999; Kumar 2009
64	Bhirrana II	Bhirrana	75	33.38	29	33.47	206	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009
65	Chimun I	Chimun	75	39.36	29	40.2	211	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009
66	Lamba	Lamba	75	40.48	29	42.35	217	-	-	-	-	-	1	1	
67	Badalgarh	Badalgarh	75	39.16	29	46.13	210	-	-	-	-	-	-	1	
68	Musa Khera	Musa Khera	75	43.08	29	44.02	215	-	-	-	-	-	1	-	
69	Ratta Theh	Ratta Theh	75	42.13	29	42.57	202	1	1	-	-	-	-	-	Possehl 1999; Kumar 2009
70	Karandi	Karandi	75	41.18	29	42.08	206	-	-	-	-	-	-	1	
71	Ghaswa I	Ghaswa	75	40.11	29	41.07	205	1	-	-	-	-	-	-	Possehl 1999; Kumar 2009
72	Ghaswa II	Ghaswa	75	40.36	29	41.07	208	-	-	-	1	-	-	1	Possehl 1999; Kumar 2009
73	Chimun II	Chimun	75	39.53	29	40.39	226	-	-	-	-	-	1	-	Possehl 1999; Kumar 2009
74	Dharsul Kalan I	Dharsul Kalan	75	44.12	29	40.36	218	-	-	-	-	-	1	-	
75	Diwana	Diwana	75	44.34	29	41.3	211	-	-	-	-	-	-	1	Possehl 1999
76	Dharsul Kalan II	Dharsul Kalan	75	44.29	29	39.59	206	-	-	-	-	-	-	1	
77	Kullan	Kullan	75	43.45	29	40.02	206	-	-	-	-	-	-	1	
78	Bhuna I	Bhuna	75	44.33	29	32.05	213	-	-	-	-	-	-	1	Chakrabarti and Saini 2009
79	Khasa	Khasa	75	45.05	29	32.34	212	-	-	-	-	-	1	1	
80	Bhuna II	Bhuna	75	42.01	29	31.58	218	-	-	-	-	-	1	1	Chakrabarti and Saini 2009

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
81	Dulat	Dulat	75	44.31	29	33.49	217	-	-	-	-	-	-	1	
82	Bahunra	Bahunra	75	41.18	29	37.36	209	-	-	-	-	-	-	1	Kumar 2009
83	Kheri Rayan	Kheri Rayan	75	42.57	29	37.32	208	-	-	-	-	-	-	1	
84	Laharian I	Laharian	75	44.31	29	37.32	208	-	-	-	-	-	1	1	
85	Laharian II	Laharian	75	43.3	29	37.5	203	-	-	-	-	-	-	1	
86	Zabtewala	Zabtewala	75	42.02	29	39.38	220	-	-	-	-	-	1	1	
87	Nanheri I	Nanheri	75	41.42	29	39.58	204	-	-	-	-	-	1	-	Chakrabarti and Saini 2009
88	Nanheri II	Nanheri	75	41.05	29	40.01	201	-	-	-	-	-	-	1	Chakrabarti and Saini 2009
89	Khera (Bhuthan)	Khera (Bhuthan)	75	36.25	29	34.58	202	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009; Chakrabarti and Saini 2009
90	Bhuthan Khurad	Bhuthan Khurad	75	35.32	29	33.47	209	-	-	-	-	-	-	1	
91	Bhuthan Kullan	Bhuthan Kullan	75	35.52	29	32.27	210	-	-	-	-	-	1	-	
92	Jandli Khurad I	Jandli Khurad	75	40.35	29	30.6	212	-	-	-	-	-	1	-	
93	Jandli Khurad II	Jandli Khurad	75	37.51	29	31.54	218	-	-	-	-	-	1	-	
94	Chandrawal	Chandrawal	75	37.42	29	21.13	223	-	-	-	-	-	1	1	
95	Hasanga I	Hasanga	75	36.5	29	36.1	180	-	-	-	-	-	-	1	Kumar 2009
96	Hasanga II	Hasanga	75	37.07	29	36.05	203	-	-	-	-	-	-	1	Kumar 2009
97	Hasanga III	Hasanga	75	37.45	29	36.19	210	-	-	-	-	-	1	1	
98	Nadhuari I	Nadhuari	75	38.32	29	34.11	223	-	-	-	-	-	-	1	
99	Nadhuari II	Nadhuari	75	39.08	29	34.24	205	-	-	-	-	-	-	1	
100	Nadhuari III	Nadhuari	75	39.07	29	34.48	209	-	-	-	-	-	-	1	
101	Ghotru	Ghotru	75	38.22	29	35.47	214	-	-	-	-	-	-	1	
102	Aharwan I	Aharwan	75	32.06	29	36	181	-	-	-	-	-	-	1	
103	Aharwan II	Aharwan	75	32.23	29	36.33	209	-	-	-	-	-	1	1	
104	Palsar	Palsar	75	35.33	29	35.51	206	-	-	-	-	-	-	1	
105	Pandri	Pandri	75	35.57	29	35.38	211	-	-	-	-	-	-	1	
106	Bhirrana III	Bhirrana	75	33.26	29	34.13	206	-	-	-	1	-	1	1	Possehl 1999; Kumar 2009
107	Fatehabad	Fatehabad	75	28.22	29	30.23	204	-	-	-	-	-	-	1	

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
108	Burj I	Burj	75	38.28	29	39.23	208	1	-	-	1	-	1	-	Possehl 1999; Kumar 2009
109	Burj II	Burj	75	38.18	29	39.27	203	-	-	-	-	-	-	1	Possehl 1999; Kumar 2009
110	Mohammedpur Sottar	Mohammedput Sottar	75	38.15	29	37.13	207	-	-	-	-	-	-	1	
111	Kunal I	Kunal	75	39.32	29	37.17	212	1	1	-	1	-	-	-	Possehl 1999; Kumar 2009
112	Kunal II	Kunal	75	39.23	29	37.33	210	-	-	-	-	-	1	1	Possehl 1999; Kumar 2009
113	Kunal III	Kunal	75	39.44	29	38	207	-	-	-	-	-	1	1	Possehl 1999; Kumar 2009
114	Kunal IV	Kunal	75	39.57	29	37.38	202	-	-	-	-	-	1	1	Possehl 1999; Kumar 2009
115	Lali I	Lali	75	31.59	29	42.3	205	-	-	-	-	-	1	1	
116	Lali II	Lali	75	30.28	29	42.51	202	-	-	-	-	-	1	1	
117	Sukhlampur	Sukhlampur (Sukhalpur)	75	35.58	29	38.19	205	-	-	-	-	-	1	1	
118	Sahnal	Sahnal	75	35	29	37.55	207	-	-	-	-	-	-	1	
119	Chando Kalan	Chando Kalan	75	37.13	29	38.3	198	-	-	-	-	-	-	1	
120	Ratia I	Ratia	75	35.35	29	41.33	200	-	-	-	-	-	1	1	
121	Ratia II	Ratia	75	33.41	29	41.51	201	-	-	-	-	-	-	1	
122	Gandhu Khurd	Gandhu Khurd	75	33.35	29	47.17	204	-	-	-	-	-	-	1	
123	Boha	Boha	75	33.36	29	50.03	204	-	-	1	-	-	1	1	Possehl 1999; Kumar 2009
124	Gamiwala I	Gamiwala	75	31.5	29	48.29	201	1	-	-	-	-	1	-	
125	Gamiwala II	Gamiwala	75	32.15	29	47.5	207	-	-	-	-	-	-	1	
126	Thalwala	Thalwala	75	32.25	29	46.24	207	-	-	-	-	-	-	1	
127	Gadhar	Gadhar (Gadharpati)	75	30.5	29	51.2	219	1	-	-	-	-	1	-	
128	Kalipur	Kalipur (Karipur)	75	33.39	29	53.37	219	-	-	-	-	-	-	1	Possehl 1999
129	Fallu Dogran	Fallu Dogran	75	31.55	29	53.57	210	-	-	-	-	-	-	1	
130	Ram Nagar Bhattal	Ram Nagar Bhattal	75	31.46	29	51.53	202	-	-	-	1	-	1	-	
131	Mal Singh Wala I	Mal Singh Wala	75	29.54	29	52.45	216	-	-	-	-	-	-	1	

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
132	Mal Singh Wala II	Mal Singh Wala	75	30.22	29	52.1	219	-	-	-	-	-	1	1	
133	Mal Singh Wala III	Mal Singh Wala	75	30.04	29	52.24	209	-	-	-	-	-	-	1	
134	Jhandonke	Jhandonke	75	21.52	29	45.15	201	-	-	-	-	-	1	1	
135	Jhuniar I	Jhuniar (Jhunir)	75	19.58	29	48.32	194	-	-	-	-	-	-	1	
136	Jhuniar II	Jhuniar (Jhunir)	75	22.24	29	48.29	210	-	-	-	-	-	1	-	
137	Danewala I	Danewala	75	23.18	29	48.38	207	-	-	-	-	-	1	1	Possehl 1999
138	Danewala II	Danewala	75	23.48	29	48.27	198	1	1	-	-	-	1	1	Possehl 1999
139	Danewala III	Danewala	75	23.39	29	49.09	201	-	-	-	-	-	-	1	
140	Fatehpur	Fatehpur	75	24.06	29	46.06	203	-	-	-	-	-	1	1	Possehl 1999; Kumar 2009; Chakrabarti and Saini 2009
141	Mofar	Mofar	75	24.32	29	47.26	201	-	-	-	-	-	-	1	
142	Faridke	Faridke	75	26.44	29	47.58	208	-	-	-	-	-	-	1	
143	Nandgarh	Nandgarh	75	25.15	29	48.23	206	1	-	-	-	-	1	-	Possehl 1999; Kumar 2009; Chakrabarti and Saini 2009
144	Dalelwala I	Dalelwala	75	25.34	29	50.29	211	-	-	-	-	-	1	-	Possehl 1999
145	Dalelwala II	Dalelwala	75	24.14	29	49.53	204	-	-	-	-	-	-	1	Possehl 1999
146	Alimpur Mandran I	Alimpur Mandran (Alampur)	75	26.09	29	50.07	207	-	-	-	-	-	1	1	
147	Alimpur Mandran II	Alimpur Mandran (Alampur)	75	27.4	29	50.43	199	-	-	-	-	-	1	-	
148	Alimpur Mandran III	Alimpur Mandran (Alampur)	75	27.46	29	49.1	202	-	-	-	-	-	-	1	
149	Uddat Saidewala	Uddat Saidewala	75	27.52	29	48.27	207	-	-	-	-	-	1	-	
150	Malakpur Bhimra	Malakpur Bhimra	75	28.34	29	47.55	210	-	-	-	-	-	1	1	Kumar 2009
151	Thalwala II	Thalwala	75	31.37	29	46.03	182	-	-	-	-	-	1	-	
152	Thalwala III	Thalwala	75	31.33	29	46.2	200	-	-	-	-	-	1	-	
153	Naggal I	Naggal	75	30.19	29	46.18	207	-	-	-	-	-	-	1	
154	Naggal II	Naggal	75	30.35	29	46.13	206	-	-	-	-	-	1	1	
155	Naggal III	Naggal	75	30.09	29	46.11	207	-	-	-	-	-	1	1	
156	Sardarewala	Sardarewala	75	29.12	29	46.15	216	-	-	-	-	-	1	-	

GHS No.	GHS Site name	Village	East Deg. Mins.		North Deg. Mins.		Elev. asl	EHar	MHar	LHar	PGW	NBP	EHis	Med	Previous reporting
157	Ladhuwas I	Ladhuwas	75	28.46	29	46.5	207	-	-	-	-	-	1	-	
158	Ladhuwas II	Ladhuwas	75	28.03	29	47.09	204	-	-	-	-	-	-	1	
159	Ladhuwas III	Ladhuwas	75	28.06	29	47.41	206	-	-	-	-	-	-	1	
160	Ladhuwas IV	Ladhuwas	75	28.42	29	47.35	208	-	-	-	-	-	1	1	
161	Mirrana	Mirrana	75	32.05	29	42.46	205	-	-	-	1	-	-	-	Possehl 1999
162	Korwala I	Korwala	75	22.59	29	49.21	197	-	-	-	-	-	-	1	
163	Korwala II	Korwala	75	22.23	29	50.57	210	-	-	-	-	-	-	1	
164	Fatehgarh Shahnawali I	Fatehgarh Shahnawali	75	18.57	29	49.37	205	-	-	-	-	-	-	1	Possehl 1999
165	Fatehgarh Shahnawali II	Fatehgarh Shahnawali	75	19.31	29	50.19	198	-	-	-	-	-	-	1	Possehl 1999
166	Bhama Khurad	Bhama Khurad (Bhame Khurad)	75	21.57	29	51.33	200	-	-	-	-	-	1	1	
167	Kot Dharmun	Kot Dharmun (Kot Dharmu)	75	23.13	29	52.17	199	-	-	-	-	-	-	1	
168	Chhachhohar	Chhachhohar	75	23.32	29	50.22	203	-	-	-	-	-	-	1	
169	Lakhmirwala	Lakhmirwala	75	23.49	29	51.13	206	1	1	-	-	-	-	-	Possehl 1999
170	Narayangarh	Narayangarh	75	25.05	29	54.06	209	1	-	-	-	-	1	1	
171	Karanpur I	Karanpur (Akkanwali)	75	25.03	29	51.56	215	-	-	-	-	-	-	1	Possehl 1999
172	Karanpur II	Karanpur (Akkanwali)	75	25.24	29	51.26	207	-	-	-	-	-	-	1	Possehl 1999
173	Karanpur III	Karanpur (Akkanwali)	75	24.47	29	51.1	202	-	-	-	-	-	1	-	Possehl 1999
174	Alimpur Mandran IV	Alimpur Mandran (Alampur)	75	28.23	29	50.5	212	-	-	-	-	-	1	1	
175	Mandhali II	Mandhali	75	27.02	29	52.56	203	-	-	-	-	-	-	1	Kumar 2009
176	Mandhali II	Mandhali	75	26.18	29	53.21	204	-	-	-	-	-	-	1	Kumar 2009
177	Saharan	Saharan	75	25.42	29	53.22	201	-	-	-	-	-	-	1	
178	Pipalian	Pipalian	75	28.07	29	54.1	213	1	-	-	-	-	-	-	Possehl 1999
179	Barah I	Barah	75	28.52	29	55.26	206	1	-	-	-	-	1	1	
180	Barah II	Barah	75	29.09	29	53.56	205	-	-	-	-	-	-	1	
181	Barah III	Barah	75	30.23	29	24.35	200	1	1	-	-	-	1	-	
182	Ratia III	Ratia	75	36.08	29	40.3	201	-	-	-	-	-	-	1	

A total of 182 sites were located during the *Ghaggar Hinterland Survey* (Table 1). The number of sites dating to each period is as follows: 17 Early Harappan, 8 Mature Harappan, 2 Late Harappan, 11 PGW, 0 NBPW, 77 Early Historic and 136 Medieval. Up to 125 of these have not been recorded in previous survey reports and compilations (e.g. Joshi *et al.* 1984; Possehl 1999; Kumar 2009; Chakrabarti and Saini 2009), meaning that up to 69% of sites within this particular area were hitherto undocumented. In contrast to the *Rakhigarhi Hinterland Survey* (Singh *et al.* 2010), the chronological distribution of these new sites is skewed towards the Early Historic (77 sites, 42% new) and Medieval period (136 sites, 74% new), suggesting that previous surveys have focussed on the identification of Indus Civilisation sites and have possibly not recorded later period sites. A total of 6 new Early Harappan sites were identified out of a total of 17, only one Mature Harappan site was new to knowledge, and no new Late Harappan sites were discovered. The distribution of sites in each of these periods is shown in Figures 3-8, which also indicate the purported course of the Ghaggar palaeochannel.

The survey has shown that there is considerable change in the location and concentration of settlements over time, and the distribution of sites in the different periods is in many ways surprising. As shown in Fig. 3, the Early Harappan settlements appear to have been distributed across the plain, with several sites being located in close proximity to the palaeochannel. While it is notable that all of the Early Harappan settlements in the southern part of the survey area actually appear to have been located adjacent to this palaeochannel, proportionally this is a small number of sites, and with the exception of Banawali, they are all small village settlements. The larger Early Harappan sites in the survey area are both situated some distance to the north of the palaeochannel, and lie in the more northerly cluster of sites that makes up the largest proportion of

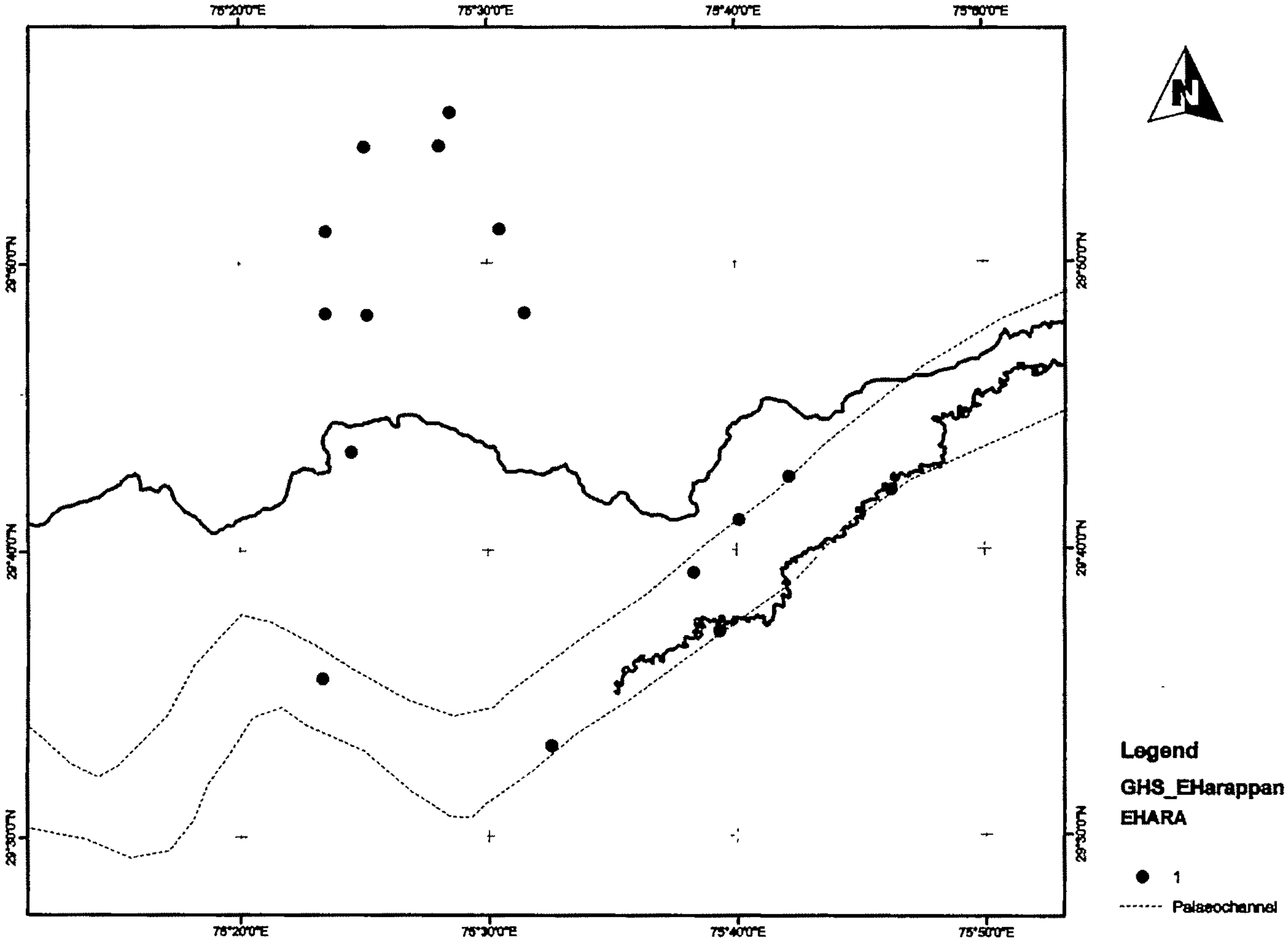

Fig. 3: Distribution of Early Harappan settlements in the *Ghaggar Hinterland Survey* study area

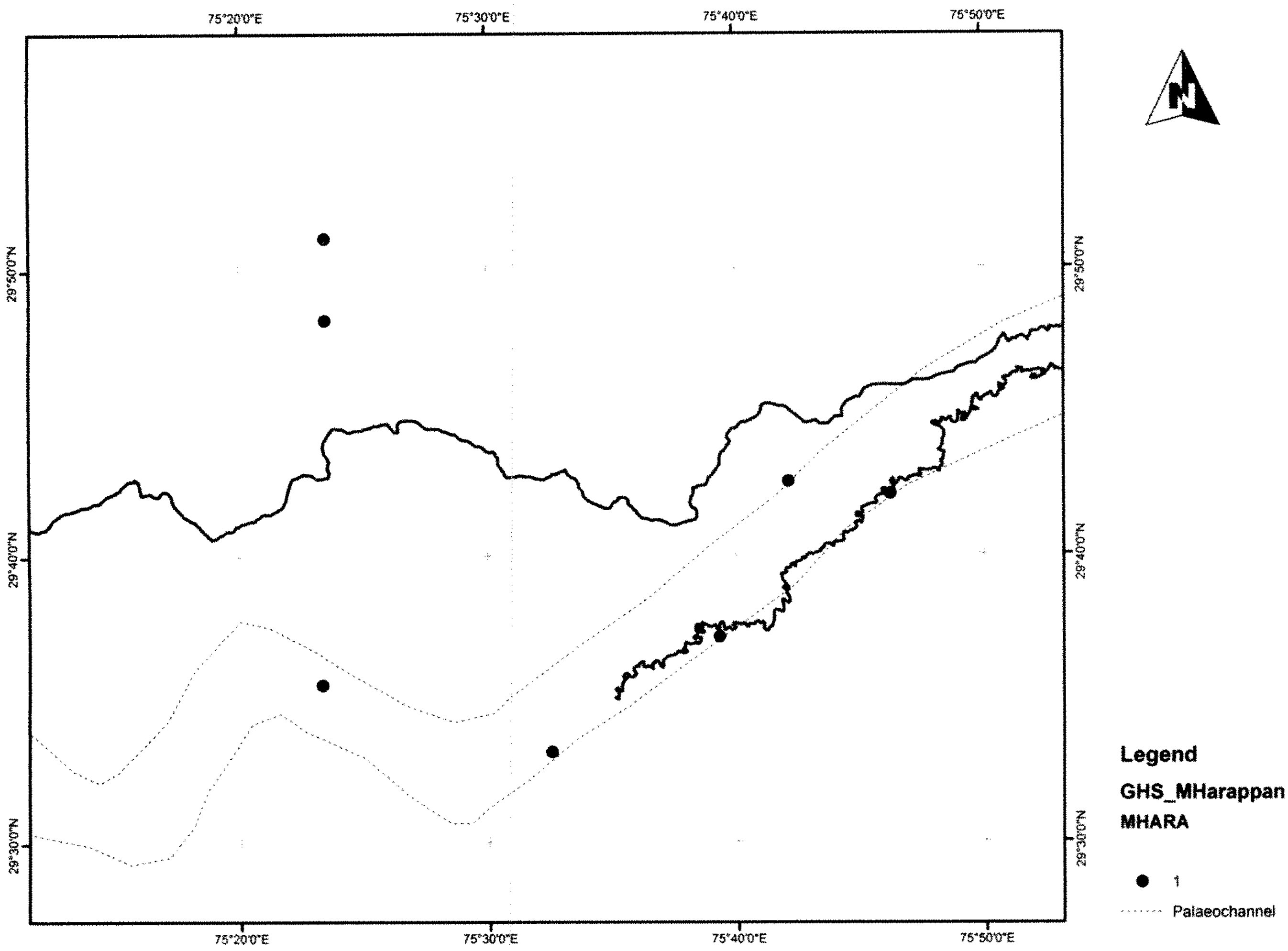

Fig. 4: Distribution of Middle Harappan settlements in the *Ghaggar Hinterland Survey* study area

the Early Harappan sites and includes the site of Lakhmirwala, which was recorded as being 5 ha in size. Perhaps the most marked shift for the early phases of settlement is between the Early and Middle Harappan periods, where more than half of the sites were abandoned, including both of the larger sites to the north of the study area and two of the sites situated adjacent to the palaeochannel (Fig. 4). This implies a degree of depopulation of the middle course of the Ghaggar during the Indus urban period. With the shift to the Late Harappan period, there is more site abandonment, and Banawali appears to have been the only site still occupied in the southern part of the survey area, which the lone Late Harappan site in the northern region is a new foundation (Fig. 5). The reduction in site numbers along the palaeochannel across the Early-Middle Harappan and Middle-Late Harappan transitions would seem to support the idea that it may have dried up at some point after the mid-3rd millennium B.C., but there is evidence for more widespread occupation in this region during the PGW period, which indicates that the palaeochannel may not have been critical for settlement (Fig. 6). It is notable that there were no NBPW sites identified during the *Ghaggar Hinterland Survey*, which shows clear variation with the results for the same period for the *Rakhigarhi Hinterland Survey*, where six sites were recorded. As a whole, the relatively sparse evidence for proto-historic occupation stands in stark contrast to that for the Early Historic (Fig. 7) and Medieval (Fig. 8) periods, which indicate that the settlement became increasingly intensive in the survey region during the historic period. Rather than the drop off between Early Historic to Medieval periods seen in the *Rakhigarhi Hinterland Survey*, the *Ghaggar Hinterland Survey* also revealed an almost two-fold increase in the number of settlements in the Medieval period.

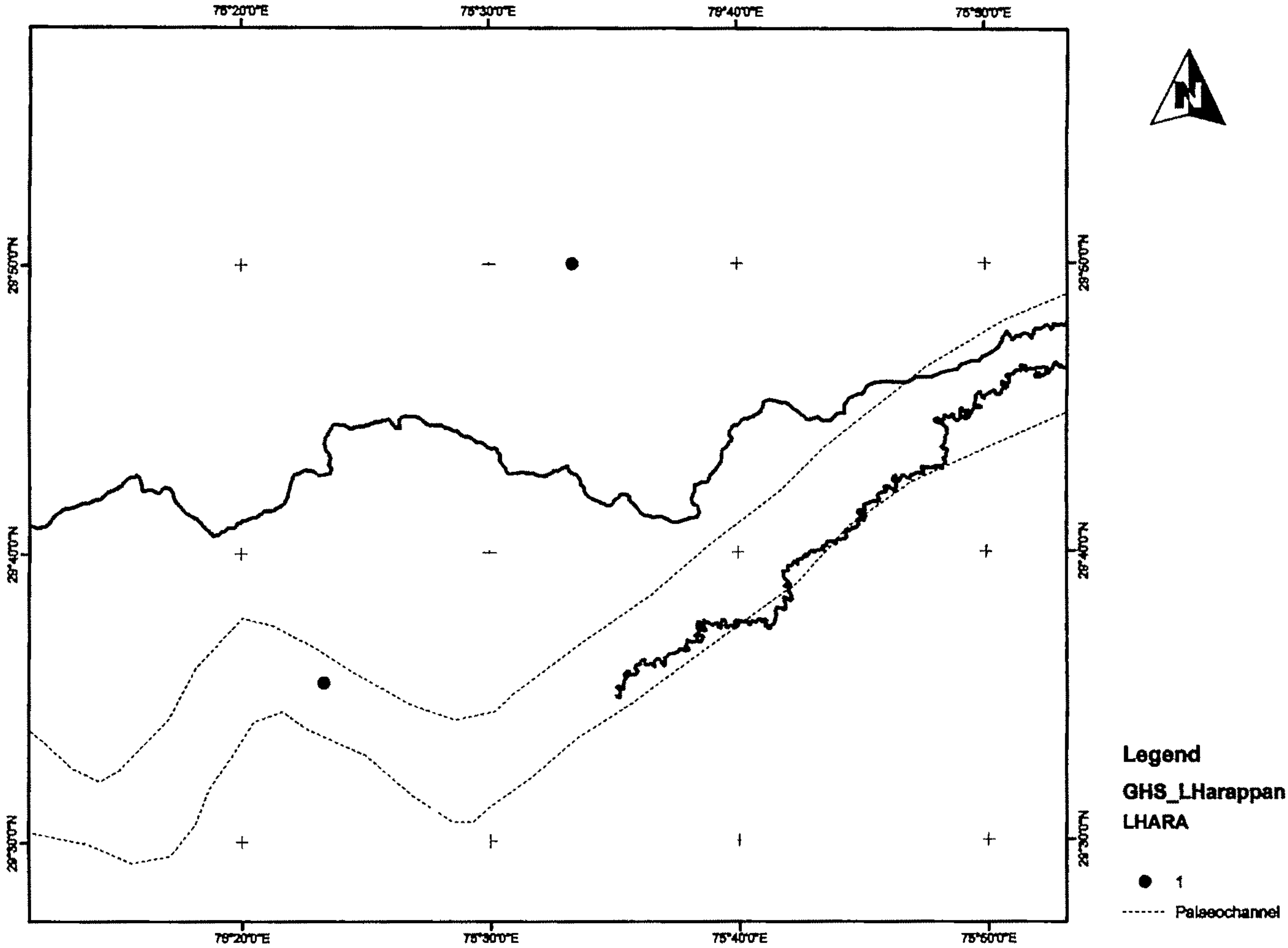

Fig. 5: Distribution of Late Harappan settlements in the *Ghaggar Hinterland Survey* study area

Perhaps most significantly, the results of the *Ghaggar Hinterland Survey* do not conform to claims that there was intensive or concentrated settlement along the channel during the Mature Indus period (e.g. Valdiya 2002; Lal 2002; Danino 2010). In fact, the results of the *Ghaggar Hinterland Survey* appear to indicate that this part of the plain was relatively sparsely occupied during proto-history and that the middle course of the Ghaggar was not an area of intensive in the Early, Middle or Late Harappan periods. As noted for the *Rakhigarhi Hinterland Survey*, the *Ghaggar Hinterland Survey* shows that Early Historic and Medieval period sites are, in general, distributed evenly across the whole of the study area, which potentially implies that adaptations to agricultural practices facilitated more widespread settlement than was possible in the protohistoric period.

Discussion and suggestions for the future

The reconnaissance, *Rakhigarhi* and *Ghaggar Hinterland Surveys* carried out by the *Land, Water and Settlement Project* have shown that the locations of large number of sites that appear in many of the site registers are incorrect. This means that it is impossible to discuss past settlement and/or landscape dynamics on the plains of northwest India with any substantiation using the existing data sets. The two *Land, Water and Settlement Project* surveys also confirm that the current estimates of site frequency in northwest India are almost certainly too low. It is now clear that many modern villages appear to overlie ancient sites, and that these and many sites have not previously been recorded. This latter factor is particularly the case for Early Historic and Medieval sites, which are largely absent from compilations of site survey data. The general lack of problem-oriented research thus makes it

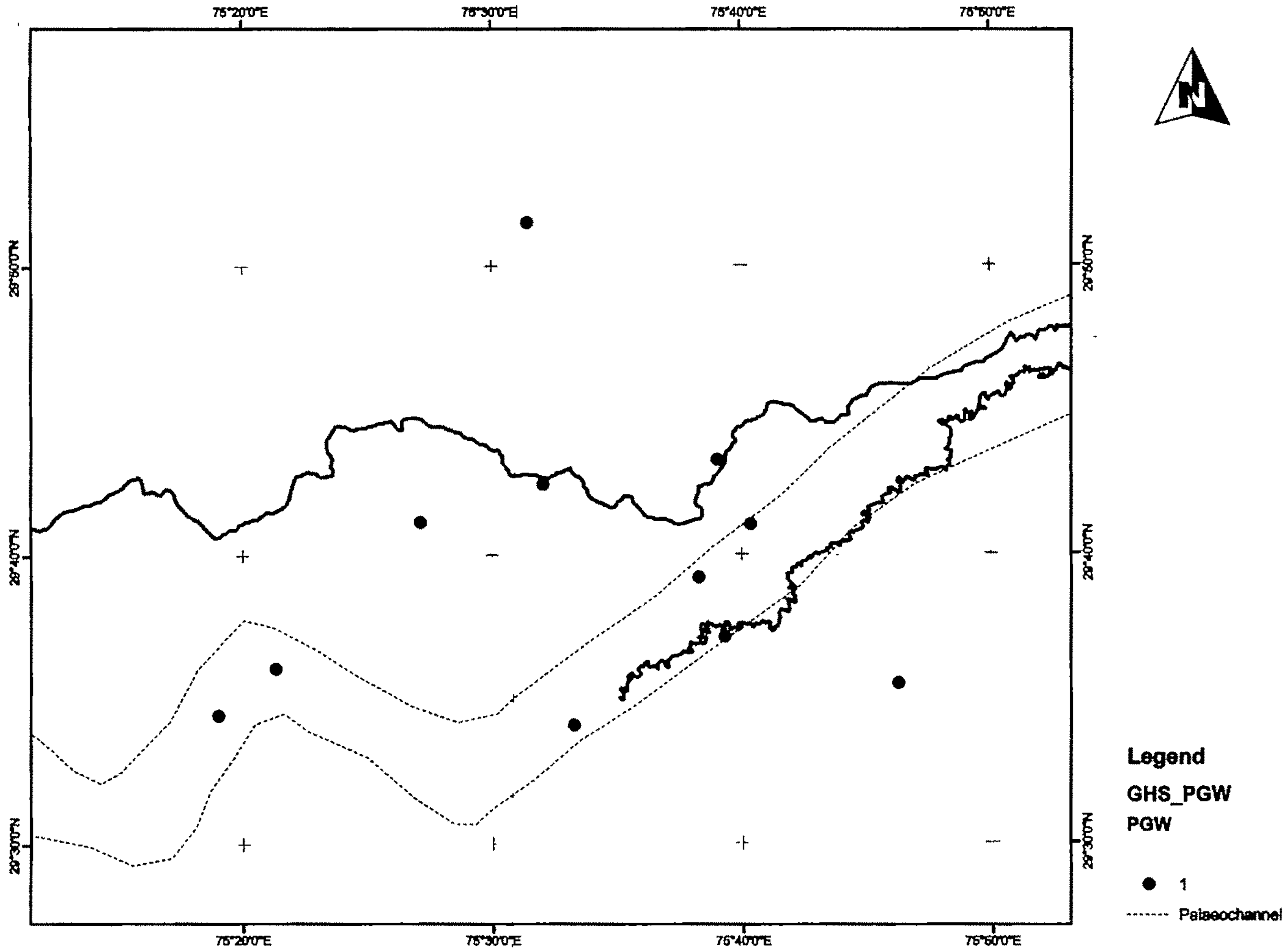

Fig. 6: Distribution of PGW settlements in the *Ghaggar Hinterland Survey* study area

difficult to draw broader conclusions about settlement dynamics.

The *Ghaggar Hinterland Survey* indicates that the relationship between archaeological settlements and modern ephemeral and palaeo-watercourses is far from straightforward, and confirms that the purported relationship between proto-historic archaeological sites and the various large-scale hydrological features that cross the plains of northwest India is likely to have been overstated. There remains much to learn about the palaeochannels of northwest India, and, systematic sub-surface coring in relevant areas correlated with targeted archaeological and geoarchaeological investigation, will be the only way of establishing the absolute chronology and interrelationship of these features.

Singh *et al.* (2010) have noted previously that the most recent synthesis of the survey evidence by Kumar (2009) has shown that sites with evidence for occupation during the Early, Middle and/or Late Harappan phase are widely distributed across the plains of Haryana. While important sites like Banawali, Kunal and Bhirrana all lie in close proximity to the Ghaggar, sites like Rakhigarhi and Farmana, which are the largest Harappan sites on the plains of northwest India, are located some distance to the south, and each lay in subtly different environmental zones (Singh *et al.* 2010). Furthermore, in contrast to the claim that a large number of Indus sites are located along the course of these channels (e.g. Valdiya 2002: Figs. 4.3, 4.5; Bhadra *et al.* 2009: 278-280), there are actually far fewer Early, Mature and Late Harappan period sites along the proposed course of the palaeo-Ghaggar than in the regions around Rakhigarhi (see Kumar 2009: Figs. 6-9). These observations have both been confirmed by the *Ghaggar Hinterland Survey*. It is not yet clear how the surprising distribution pattern

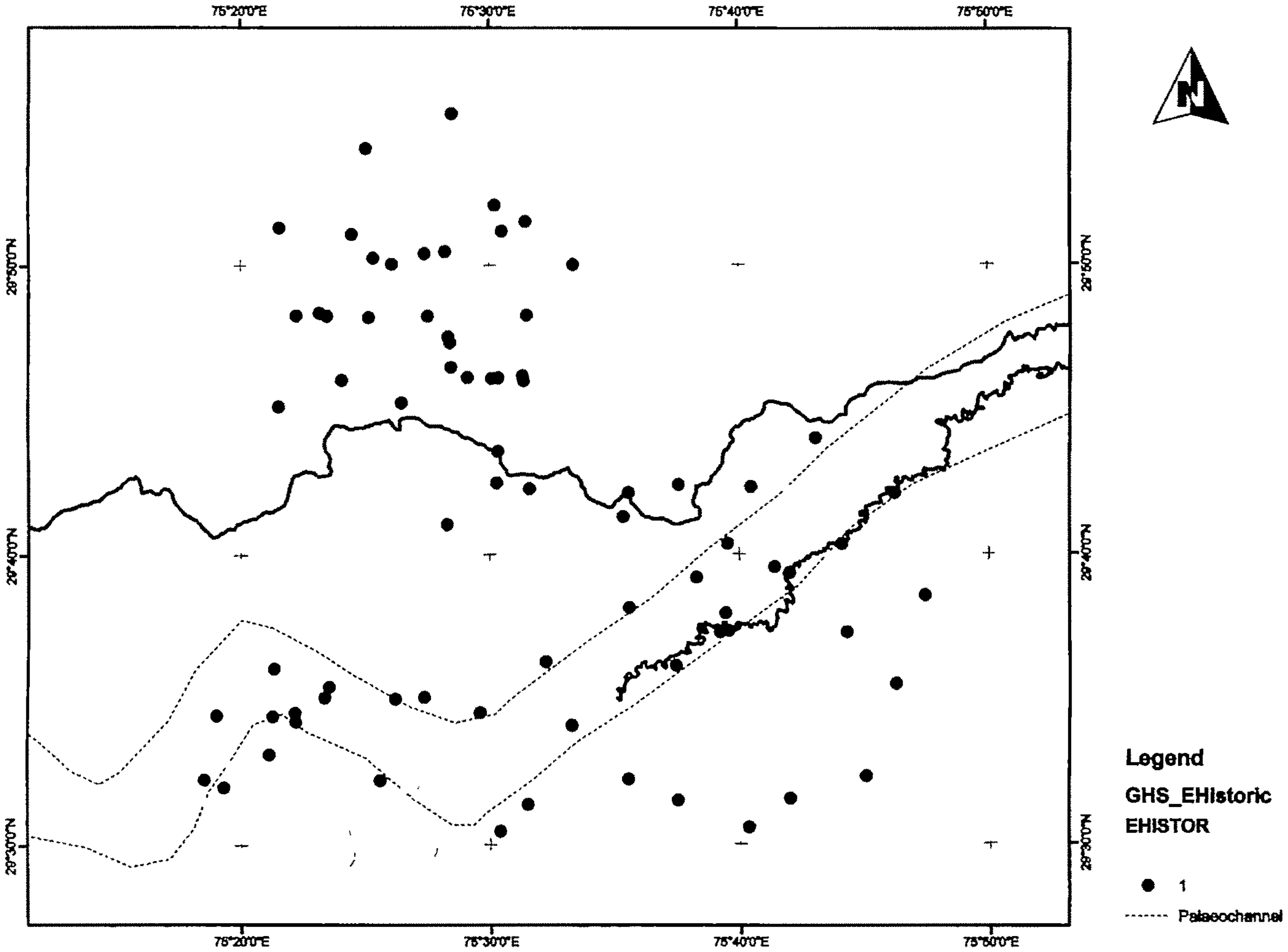

Fig. 7: Distribution of Early Historic settlements in the *Ghaggar Hinterland Survey* study area

of Middle Harappan sites in the *Ghaggar Hinterland Survey* area should be explained. As suggested previously (Singh *et al.* 2010), it is likely that the inhabitants of the plains of what is today northwest India probably used a range of water sources throughout the year, much as is done today. There has been a tendency to assume that the Indus agricultural system was homogenous, but it is almost certain that variation in local environmental conditions and water supply would have necessitated different adaptations in practices. The reconstruction of farming practices and strategies across the plains is an obvious avenue for future research.

It is important to aspire to a more refined understanding of the proto-historic and historic settlement dynamics of northwest India, and this will inevitably necessitate further surveys to revise the locations of all of the archaeological sites on the plains. A far more systematic approach to surveying needs to be instituted, as the *Rakhigarhi* and *Ghaggar Hinterland Surveys* have both shown that large number of sites remain unidentified. Until new systematic work is carried out we will only have a partial picture of proto- and historic settlement patterns in the region. Furthermore, grounded conclusions will only be possible when surveys are partnered with detailed stratigraphic excavations aimed at understanding the chronology and dynamics of individual settlements and their relationships to water resources and the environment. Perhaps most importantly, the results of the *Rakhigarhi* and *Ghaggar Hinterland Surveys* suggest that existing hypotheses about the impact of changing hydrological systems on the Indus Civilization are in need of re-examination. Problem-oriented investigations focussing on establishing the precise relationship between settlement, water resources and the landscape are essential, and it is only through such

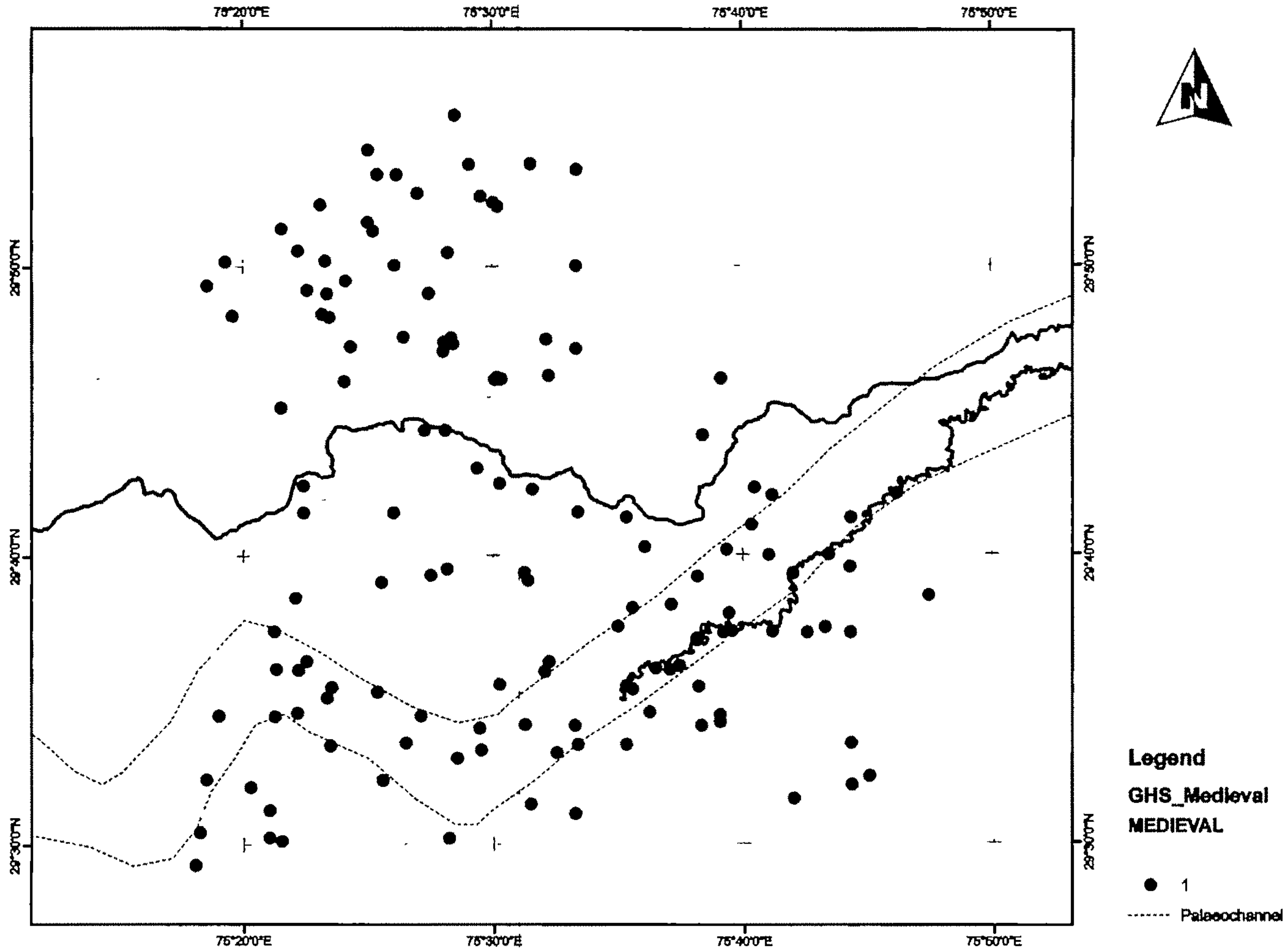

Fig. 8: Distribution of Medieval settlements in the *Ghaggar Hinterland Survey* study area

approaches that it will be possible to establish how the human populations of northwest India interacted with the land.

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Sila Tripati, *et al*, *Man and Environment* XXXVI(2): 107-116 [2011].
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Study of Chinese Porcelain Sherds of Old Goa, India: Indicators of Trade Contacts

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Abstract

Chinese ceramics have a long history of evolution and distribution. Chinese ceramics have been discovered from habitations, ports, trade centres and shipwrecks sites which facilitated the precise dating of sites and associated findings. The paper deals with Chinese porcelain sherds found during exploration at Old Goa. The role of Chinese ceramics in maritime history between Goa and Portugal, their period and kiln have been described and compared with similar sherds which were found at the St Augustine Church of Old Goa.

Introduction

Archaeological artefacts provide information on development of a culture, and, the study of ceramics contributes to an understanding of the progress made in the field of science and technology. Over a period of time numerous changes have been noticed in the selection of clay, firing techniques (from hearths to kilns), paintings, designs and decorations of Chinese ceramics. The finding of ceramics from habitation sites, trade centres and shipwrecks indicate the role played in both, inland and maritime trade. Ceramics of different periods have been identified on the basis of painting, texture, design, etc. If the evolution of ceramics is taken into account i.e; from clay ware to celadon ware, stone ware and Chinese ceramics; the Chinese ware could be considered the best in terms of their fabric, quality and durability. Chinese ceramic sherds never disintegrate like other perishable material; because they are hard, sturdy and fired over 1300 °C. Hence ceramics are of extreme importance for archaeologists to date their sites and findings.

Chinese ceramics have been reported from many sites of India, more commonly from the early medieval period onwards, and there is hardly any site in India without such ceramics (Muhammed 1994). During explorations at Old Goa, Chinese ceramic sherds have been collected and designated in this paper. The sherds have been compared with those found from St. Augustine Church at Old Goa, and their role in the maritime trade contacts between Goa and Portugal is discussed.

History of Chinese Ceramics

Chinese ceramics have a long history. The production of deluxe porcelain ware was started during the Tang dynasty (618-907 A.D.). The Tang dynasty ceramics have two innovative characters viz. fine white earthenware covered with a lead glaze of glowing yellow and green tints, and thin, delicate bowls and vases with clear, bluish or greenish glazed porcelain. Sulaiman (851 A.D.), the Arab merchant referred to the manufacturing of Chinese porcelain in China (Shen 1996). During the Tang dynasty, ceramics were exported to India, Southeast Asia and the Muslim Empires.

Blue and white porcelain came to light during the Yuan dynasty (1279-1368 A.D.) but reached a high water-mark during the Ming (1368-1644 A.D.) and Qing dynasties (1644-1911 A.D.). The quality of the Ming blue and whites is indisputably superior to those of other periods and the production was plenty (Lion-Goldschmidt 1978). The most popular decorative motifs of the Ming dynasty were the dragon and phoenix. The decoration on the blue and white and polychrome wares included plants such as

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Received : 09-03-2011
Revised : 22-08-2011
Accepted : 25-09-2011

peony, prunus, chrysanthemum, pine, lotus, birds and butterflies, dragons, deer and other animals. A study of these motifs provides an insight into the socio-cultural life and religious belief of the contemporary Chinese society. Most of the decorative elements and symbols originated from Chinese folklore, history, mythology, religion traditions and each symbol carries some message. The marks and seals on Chinese porcelain have been classified into six groups (Bushell 1985). The mark of dates are inscribed, six characters indicate the reign of an emperor and four characters denote dynasty; hall marks represent the factory; marks of dedication and good wishes symbolise good luck, longevity, long life, honour, etc.; pictorial marks are related to Chinese lore, Buddhist symbols, Taoist symbols, etc. and the potters' mark signifies manufacturers' symbols. During the Ming dynasty Jingdezhen near Nanking was the main centre of production of porcelain ware, and from here it was exported to different parts of the world (Savage 1961). During the Qing dynasty (1644-1911 A.D.), Chinese porcelain was enriched with the innovation of five coloured wares which gained the highest recognition in the West (Calvao 1999). The quality of Chinese porcelain began to decline after the end of the Qing dynasty, but however, revived in a later period.

Finding of Chinese ceramic from Trade Centres and Shipwrecks

The overseas export of Chinese ceramics started from the 8th-9th centuries onwards and it increased during the rule of the Song and Yuan dynasties from the 13th century onwards (Karashima 2004). Chinese merchants brought Chinese porcelain, carpets, saffron, paper, ink, silk and tin, and in return they carried textiles, pearls, corals and aromatic wood and jasmine flowers from India and the Indian Ocean region (Mathew 1983). The Chinese Junks visited the Persian Gulf and other regions and articles brought from Sri Lanka, Malacca, Pegu and western Mediterranean countries were sold along the Malabar. Chinese travellers Wang Ta Yuan (1330-1349 A.D.), Fei-Hsin (1436 A.D.) and Muhuan (1451 A.D.) have mentioned the trade of blue and white Chinese porcelain to Kayamkulam, Cochin, and, Kozhikodu, of South India (Shastri 1939). During the reign of Wan Li (1573-1620 A.D.) large quantities of blue and white pottery were exported to different parts of the world and the excavations at Fatehpur Sikri have yielded sherds of the same ware (Muhammed 1994). John Carswell carried out explorations in the year 1976-78 at twenty five port sites of India and twenty nine sites of Sri Lanka to record Chinese materials. Carswell (1978) has opined that the destination of Chinese ceramics was at the capitals and small principalities. Recently, the joint explorations carried out by the Indian and Japanese scholars at the port sites of Kottapatnam, Krishnapatnam, Motupalli of Andhra Pradesh; Kayal, Kulashakarapattinam, Periyapattinam, Pulicat, Sadras of Tamil Nadu; Kollam, Pandalayini of Kerala and Anuradhapuram, Mantai and Polonnaruwa of Sri Lanka coast yielded Chinese ceramics datable between the 12th-13th and 17th-18th centuries (Karashima 2002, 2009). Chinese pottery, found from other sites of India, have not been properly studied.

With the increase in popularity of Chinese ceramics, the maritime trade of China gradually grew. Ceramic trade advanced from caravan to water transport (from camels to ships) in which bulk transport became possible. Ceramics were exported to the markets of India and Sri Lanka, then to the Persian Gulf, and along the East African coast (Gerritsen 2009) either in Arab Dhows or Indian ships. Moreover, Indian Muslim mariners were engaged in the distribution of Chinese ceramics throughout the Indian Ocean region. China dominated the maritime trade until the 15th and 16th centuries, after which,, the Portuguese, Dutch and British began to dominate world trade. Vasco Da Gama carried a piece of Jingdezhen blue and white porcelain to Portugal for King Manuel. Similarly, Pedro Alvares Cabral presented to King Manuel porcelain and other exotic items which he had purchased from a ship sailing from Cambay to Mecca (Pinto de Matos 1999). Afterwards Portugal procured porcelain directly from the manufacturers in Jingdezhen (Finlay 2005). Thereafter, Chinese pottery and other artefacts gained widespread popularity throughout Europe.

Many shipwrecks have been identified and dated on the basis of the Chinese ceramics. Chinese porcelain has been reported from shipwrecks in the Southeast Asian region later than 7th-8th century A.D., for instance, the Belitung ship sunk around 826 A.D. off Sumatra, Indonesia, carrying the Tang dynasty ceramics (618-907 A.D.). This is the earliest known shipwreck on the Maritime Silk Route which had extended from the Southeast China coast through Southeast Asia to the Middle East

(Flecker 2000, 2001, and 2008). Thousand of Chinese ceramics were recovered from *Intan* shipwreck (10th century A.D.) 10 miles off the Java Sea, (Flecker 2002). An enormous quantity of Chinese porcelain manufactured at Jingdezhen in Jiangxi province of China has been salvaged from *Geldermalsen* shipwreck off South China Sea/Indonesian waters (Delgado 1997, Miller 1992). The salvaged blue and white porcelain was auctioned in Amsterdam in 1986 as 'Nanking Cargo', and sold at a record breaking price. Similarly, numerous shipwrecks such as the Ko Kradat (Green and Harper 1982), *Sea Venture* (Wingood 1982), *Spanish Armada* (Martin 1979), *Nossa Senhora dos Mártires* (Castro 2005, Desroches 1998) *Santo Antonio de Tanna* (Piercy 1979, and Sassoon 1981, 1991) and many other shipwrecks have yielded Chinese porcelain. The Portuguese shipwreck in Sunchi Reef off Goa coast has also yielded blue on white Chinese ceramic sherds (Sila Tripati *et al.* 2006).

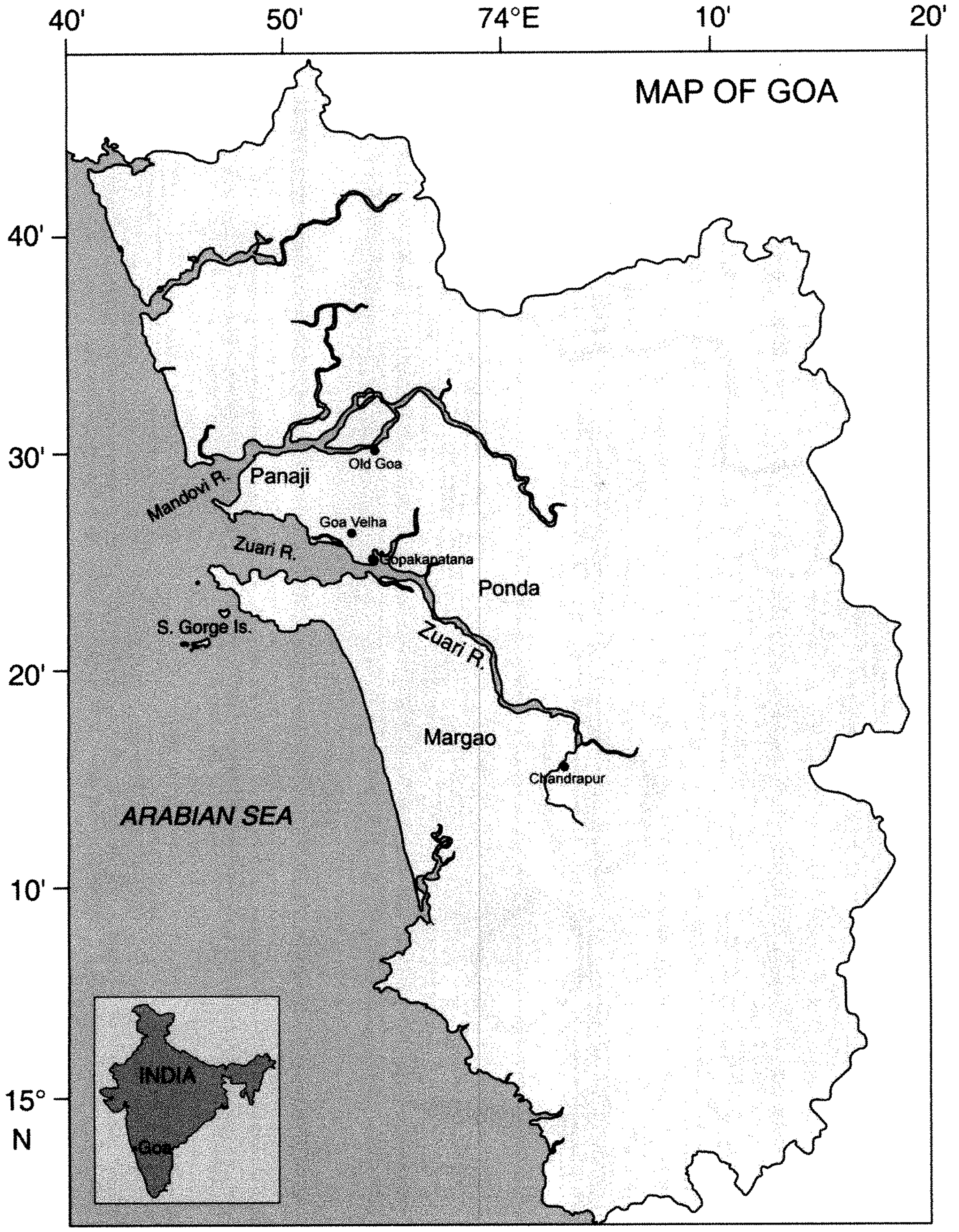
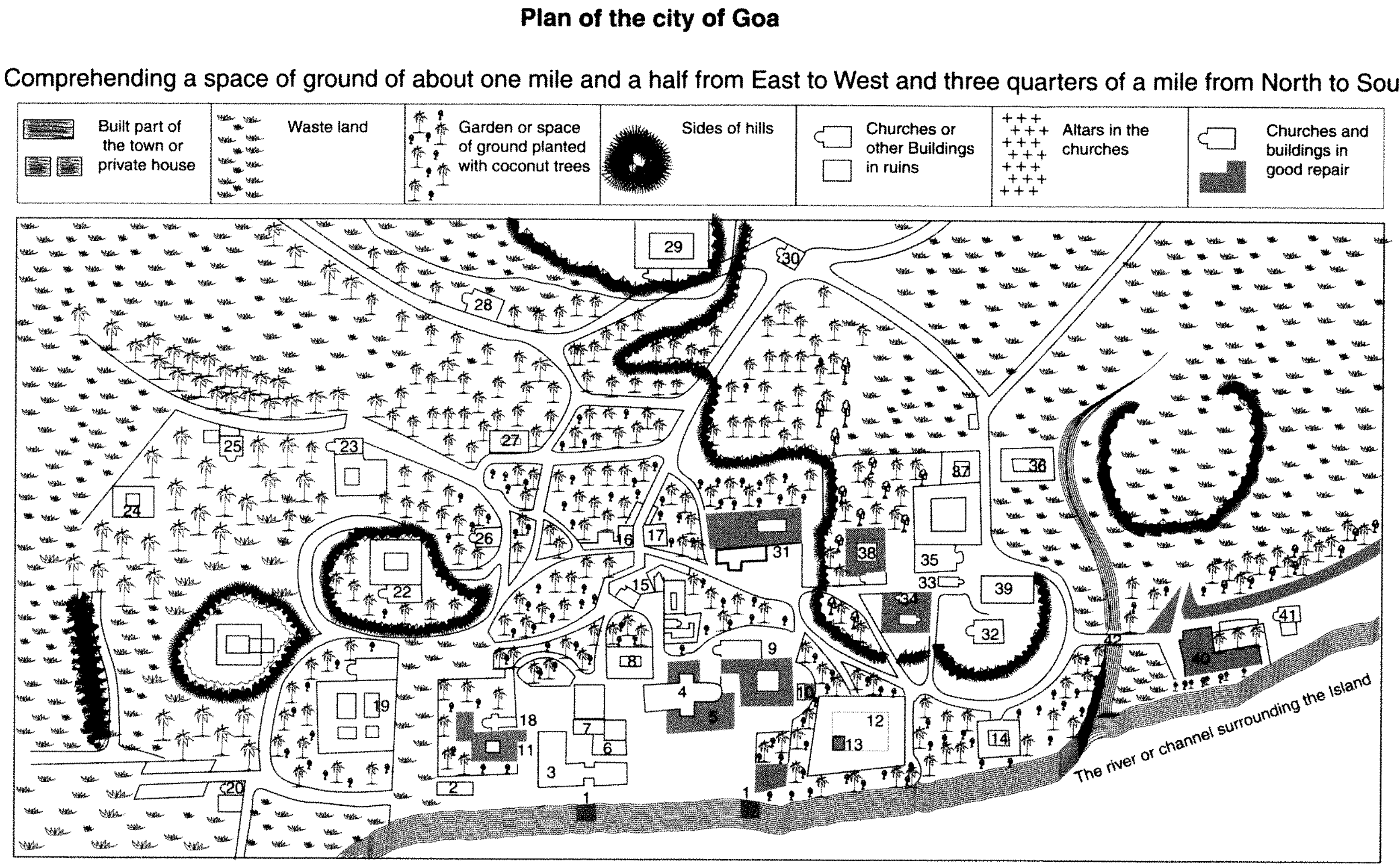
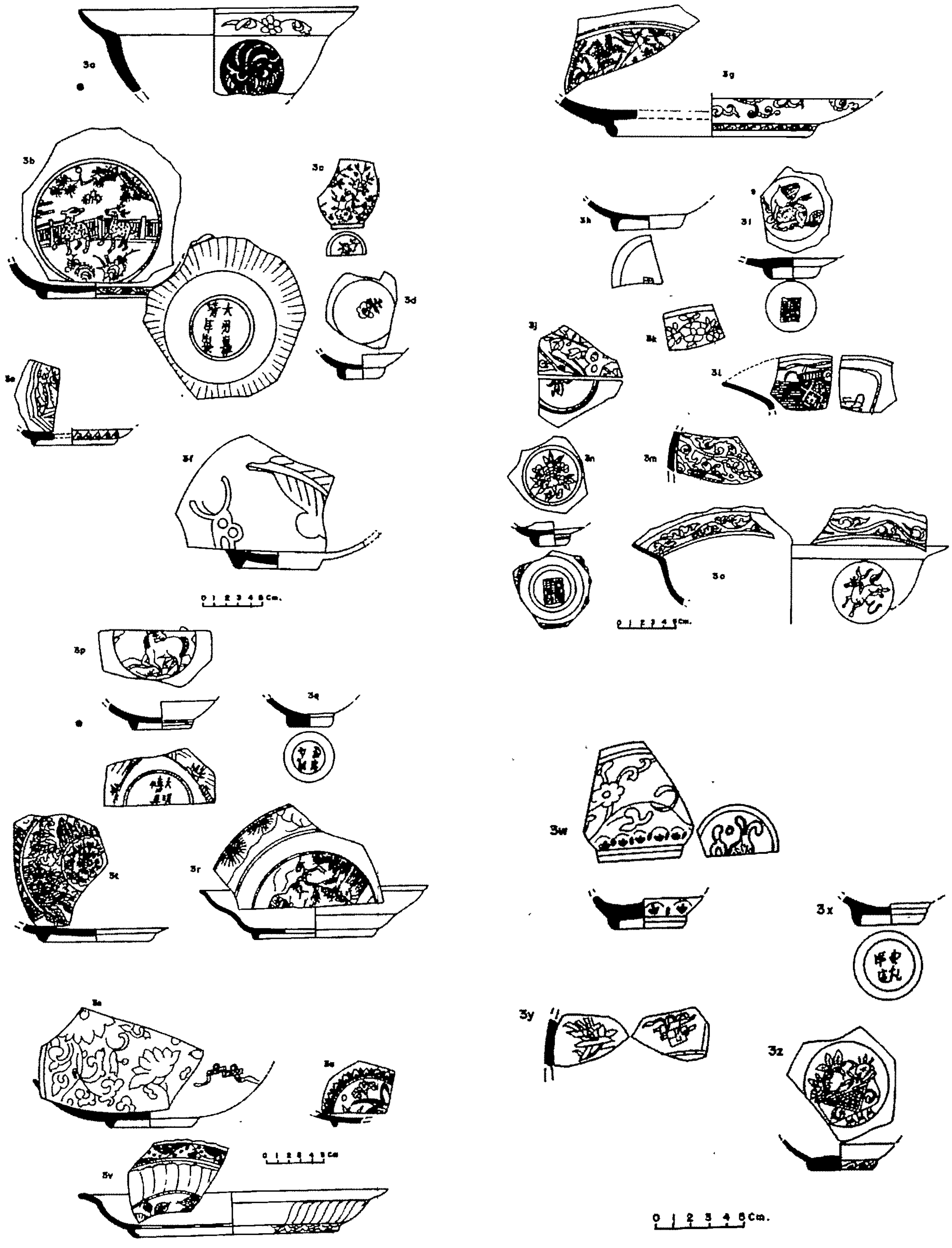

40'
50'
74°E
10'
20'
MAP OF GOA
40'
30'
20'
10'
15° N
Old Goa
Panaji
Mandovi R.
Goa Velha
Zuari R.
Gopakapatana
Ponda
S. Gorge Is.
Zuari R.
Margao
Chandrapur
ARABIAN SEA
INDIA
Goa

Fig. 1: Ports and trade centres of Goa


Plan of the city of Goa
Comprehending a space of ground of about one mile and a half from East to West and three quarters of a mile from North to South
Built part of the town or private house
Waste land
Garden or space of ground planted with coconut trees
Sides of hills
Churches or other Buildings in ruins
Altars in the churches
Churches and buildings in good repair
The river or channel surrounding the Island

1. Landing stairs
2. Custom House
3. Palace of Viceroys
4. Cathedral
5. Archiepiscopal Palace
6. Senate House
7. Old Senate House
8. Inquisition in ruins
9. Convent and church of St. Francis
10. Chapel of St. Catherine
11. Aljuvar or Archbishop's prison
12. Arsenal
13. Chapel of five wounds in the arsenal
14. College of St. Bonaventure
15. Houses and churches of Misericordia
16. Slaughter House
17. Bazar
18. Convent and church of St. Cajetan
19. Convent and church of St. Dominic
20. Parochial church of St. Lucia
21. Church and house of Nossa Senhora de Monte
22. Convent and church of Carmelites
23. College and church of St. Paul
24. Hospital of St. Lazarus
25. Parochial church of St. Thomas
26. Parochial church of St. Alexius
27. Old city hospital
28. Parochial church of Building Trinity
29. Convent and church of the Miraculous Cross
30. Parochial church of Luz
31. House and church of Bom Jesus
32. Parochial church of the Rozary
33. Chapel of St. Antony of Padua
34. Nunnery of St. Monica
35. Convent and church of St. Augustine
36. College of the Augustinians
37. Novitiate of the same
38. Convent and church of St. John of God
39. College of St. Rock in ruins
40. College of St. Thomas
41. Parochial church of St. Peter
42. Bridge

Fig. 2: Old Goa and surrounding area


3a
3b
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0 1 2 3 4 5 Cm.
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3n
3o
0 1 2 3 4 5 Cm.
3p
3q
3r
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3v
0 1 2 3 4 5 Cm
3w
3x
3y
3z
0 1 2 3 4 5 Cm.

Fig. 3: Chinese ceramics collected from Old Goa

Old Goa as a port

The early historical ports of Goa namely Chandor (Chandrapura) and Gopakapatana (Gopakapattana) (Fig. 1) were disused because of sedimentation and frequent foreign attacks. Surveys at Chandor (*IAR* 2001-02) and Gopakapatana (Costa 2002) have brought to light Chinese ceramics which are yet to be studied. The capital of Goa was shifted from Gopakapatana to Ela, (the present Old Goa) in 1472 A.D. during the Bahmani rule. Yusuf Adil Shah of Bijapur conquered Goa in 1490 A.D. and Old Goa became the capital and port and trade centre of the Indian Ocean maritime trade. During this period, Goa had contacts with Arabia, Hormuz, and, Persia, and was chiefly involved in horse trade (Kamat 2000; Moraes 1990). After Portuguese occupation in 1510 A.D. the maritime trade of Goa entered into a new phase. Old Goa had many bazar streets (Fig. 2) dealing with varieties of commodities including Chinese porcelains (Fonseca 1986). Explorations between the bank of the River Mandovi and adjoining areas brought to light Chinese porcelain sherds of bowls, cups and dishes (Fig. 3 I-IV). Most sherds belongs to the Ming and Qing dynasty (16th and 17th centuries) (Table 1). Moreover all these sherds belong to Jingdezhen kiln and only one sherd (Fig. 3l) is of 'Kraak ware'. During this period Old Goa was the flourishing port and trade centre of the west coast of India.

Table 1: Table showing name of the Dynasty, Period and Kiln of Chinese ceramic sherds.

Sherd No.	Dynasty	Period	Name of the Kiln	Remarks
1	Ming	Middle to Late 16th century	Jingdezhen	
2	Ming (Jiajing Period)	Middle to Late 16th century	Jingdezhen	1522-1566 A.D.
3	Qing	Late 17th century	Jingdezhen	Over glaze Enamels
4	Ming	Middle to Late 16th century	Jingdezhen	
5	Ming-Qing	17th century	Jingdezhen	
6	Ming-Qing	17th century	Jingdezhen	
7	Ming	Middle to Late 16th century	Jingdezhen	
8	Qing (Kangxi Period)	Late 17th century	Jingdezhen	
9	Ming	Middle to Late 16th century	Jingdezhen	
10	Ming	Middle to Late 16th century	Jingdezhen	
11	Ming	Middle to Late 16th century	Jingdezhen	
12	Ming-Qing	17th century	Jingdezhen	Kraak ware
13	Ming-Qing	17th century	Jingdezhen	
14	Ming	Middle to Late 16th century	Jingdezhen	
15	Ming	Middle to Late 16th century	Jingdezhen	
16	Ming-Qing	17th century	Jingdezhen	
17	Ming-Qing	17th century	Jingdezhen	
18	Qing	Late 17th century	Jingdezhen	
19	Ming	Middle to Late 16th century	Jingdezhen	
20	Ming	Middle to Late 16th century	Jingdezhen	
21	Ming	Middle to Late 16th century	Jingdezhen	
22	Ming	Middle to Late 16th century	Jingdezhen	
23	Ming	Middle to Late 16th century	Jingdezhen	
24	Ming-Qing	17th century	Jingdezhen	
26	Ming	Middle to Late 16th century	Jingdezhen	

Description of Chinese sherds of Old Goa

1. A shallow bowl sherd with medium fabric, straight rim with a plain inner side. On the outer cavetto near the rim, a flower with leaves is decorated at intervals between two bands. A circular medallion design is depicted with spreading wings, probably an insect, with rays coming out from the body. The wings and the body are designed with a criss-cross pattern. A residue of the over glaze brown/gold served as a border (Fig. 3a).
2. Base part of a dish with a thin fabric. A male and female deer served as central decorations. Both are depicted with dots on their body, looking at each other with playful passion and bordered by a bamboo fence. The moon is decorated with a beautiful tree branch shading both the deer. Below the deer are two cactus plants with branches. All these depictions are encircled with two concentric lines. The base is bordered by two concentric lines that encircle eight Chinese characters. Six characters denote the mark of Emperor Chia Ching (Jiajing) (1522-1566 A.D.) of the Ming Dynasty period, and two characters bear the mark of Emperor Cheng Hua (1465-1487 A.D.) (Fig. 3b).
3. A sherd of a cup, an over glaze maroon rose flower with stem and leaves are bordered by blue concentric lines. The outer cavetto is an elaborate design of maroon coloured roses with stems and small branches with over glaze green leaves. In some areas, traces of over glaze gold can be seen (Fig. 3c).
4. A sherd of a cup with a ringed base. A lotus flower or a peony with leaves serves as the central decoration and bordered by a single concentric line. This type of 'Lotus Blossom' is known as Lien Hua. An ochre-coloured slip has been applied on the outer cavetto while the inner cavetto is plain white. The surface treatment is very fine compared with the other sherds and the glaze is thin and shiny (Fig. 3d).
5. A base of a bowl with a foot ring. The over glaze blue decorations in the centre consists of outline and wash design of creepers and grass roots bordered by a thick blue line. The cavetto has geometric designs with dots (Fig. 3e).
6. Sherd of a plate with thick foot ring and medium fabric. The coarse outline and wash design features the tip of a long leaf along with a flower stem along with three small leaves. The outer cavetto is plain (Fig. 3f).
7. A fragment sherd of a bowl with a foot ring. Varieties of plants and trees are decorated behind the hills, with three flags fastened on a bamboo. Two other bamboos are attached in the form of a cross with a circular object placed on top of the bamboo. Etched on the outer cavetto are floral or 'classic' designs. A band of creepers with leaves are decorated on the foot ring encircled by a band (Fig. 3g).
8. Base of a bowl with foot ring. The inside and outside of the bowl is designed with Polychrome (green, yellow and gold) combinations cover. A square mark has been shown on the base which is further subdivided into small four squares. Some marks could be missing that precludes it from identification as either a potter's mark or some Chinese epitaphs (Fig. 3h).
9. Base of a small bowl with a fine fabric and foot ring. A mythical animal, Qilin (or Kylin in some literature), dominates the central decoration. The outline and wash design shows the Qilin rearing its head. Its flying wings and tail is also represented. A Chinese mark, presently unidentified, is present at the base (Fig. 3i).
10. A fragment of a dish with thin fabric and clear glaze. Flower stems, leaves and grass roots are decorated on the outer cavetto while the central decoration is a flower/plant design surrounded by two blue concentric lines (Fig. 3j).
11. A small rim sherd of a flat round dish with fine glaze and thin fabric. Flower and stem with leaves are shown in running pattern on the inner side whereas the outer side is plain (Fig. 3k).
12. A rim fragment of thin fabric with wavy pattern on its upper part, a rectangular drum like object has been depicted on lower side having geometric designs. Several horizontal lines are drawn on either side of the drum. Potter's mark, possibly one of the eight precious things as explained by Fang-Sheng, a Lozenge (symbol of victory) is encircled on the outer surface of the sherd with two uneven bands. It is probably a sherd of the 'Kraak ware' (Fig. 3l).
13. A sherd of a dish. The outer cavetto is decorated with possibly floral scrolls in an unending style with wavy pattern (Fig. 3m).
14. It is thin and fine fabric ring base sherd of a bowl. An elaborated flower with leaves, buds and a

stem is encircled with two bands on the base. An unidentified stamp mark is designed inside the ring base (Fig. 3n).

15. A rim sherd of a medium-sized bowl. The rim is foliated and has two small perforations on its surface which were used for rebating the broken sherd with copper wire. On the inner rim is a running 'classic scroll design' while the outer rim has also a floral design. On the outer cavetto is a flying horse poised in a leap bordered by a circle (Fig. 3o).
16. A base sherd of a bowl with a foot ring. A running horse depicted in a landscape with rocks and bushes. On the outer cavetto are equidistant decorations of hills, flowers, bushes and straight horizontal lines. There are four visible Chinese characters arranged in two columns although some characters could be missing which could probably date to the Chinese emperor Hsuan Te (1426-1435 A.D.) during the Ming Dynasty (Fig. 3p).
17. It is foot ring base sherd of a small bowl with thin fabric. Two concentric lines border the foot ring. The base has four Chinese characters, among them two letters resembling Chinese emperor Cheng Hua's mark (1465-1487 A.D.) (Fig. 3q).
18. A sherd of a dish with a thin fabric. A landscape consisting of trees and bushes represent the central decoration. Full-grown flowers and stems are shown at intervals on the rim. Two leaves with a long stem are visible on the outer rim surface (Fig. 3r).
19. A sherd of plate with a rim and a base with a foot ring. The central decoration consists of lotus flowers, stems and petals. The 'SHU' denoting a pair of books is on the outer cavetto. This mark is one among the eight treasures of Buddhism (Fig. 3s).
20. This is foot ring sherd of a round plate. The central decoration consists of a flower in full blossom with petals and filled lines of hatching design. On the base is the 'Hua' mark that denotes one of the eight treasures of Buddhism (Fig. 3t).
21. A bowl base sherd with medium fabric. Flowers and grasses are depicted in the centre and encircled with two bands along with dotted designs. The outer cavetto is plain but a small trace of a stamp mark can be seen (Fig. 3u).
22. A sherd of a shallow bowl with a foliated rim and a grooved cavetto. Traces of leaves that could be the central decoration are found and encircled with two concentric lines. A thick band of wavy lines is shown along with dots and thin lines on the rim. On the outer cavetto just below the rim are flowers with creepers (Fig. 3v).
23. A sherd of a small bowl with straight sides. The central decoration consists of a flower with two shoots coming out of it and a dot is depicted between the two shoots. On the outer cavetto are flowers and leaves which are spread all over the body. Two concentric lines are present on the upper side and at the ring base (Fig. 3w).
24. A base sherd of a bowl. Four anonymous letters are stamped encircled by a band on the base. Another concentric line can be found above the foot ring (Fig. 3x).
25. It is a tiny sherd with thin fabric. The lotus flower with stems and leaves on the inner surface denotes 'Hua', meaning happy augury, and is one of the eight Buddhist emblems. The symbol on the outer side could be 'SHU' meaning a pair of books and is one of the eight precious treasures of Buddhism (Fig. 3y).
26. Ring base of a small bowl with thin fabric. A three legged decorated basket is depicted on the center which is filled with fruits and leaves. Hatched marks are represented on the outer cavetto (Fig. 3z).

Discussion and Conclusions

One of the singular contributions of China was the invention of porcelain. Initially Chinese pottery was fired at limited temperature. Over a period of time the clay is fired at high temperatures between 1250 and 1400 °C degree until it hardens into an entirely new substance which is popularly known as ceramic. Firing ceramics at high temperature enhances their durability and impermeability and changes their surface colour. Since ancient time earthen vessels were used in ships to carry consignment to distant countries, however, slowly the shape, size and design of ceramics changed. Al-Biruni (973-1050 A.D.), also detailed how the Chinese potters took care in the preparation and maturing of the clay (Lane 1950). China was engaged in ceramic trade in the world more than 2000 years ago. The designs and motifs on Chinese pottery communicate some denotation related to Chinese culture, history, or, folklore. Chinese pottery of different dynasties has been identified on the basis of painting, texture, design, even the kilns. Chinese ceramics started coming to India from around the 8th-9th century onwards, but tangible evidence indicates that maritime contact between India and China was prevalent from the Ming dynasty (1368-1644 A.D.) onwards. The first blue and white porcelain was imported to India by the rulers of Bijapur, then the Nawab of Arcot. The Ming porcelains were an indelible high water mark in the history of world art.

The explorations at Old Goa did not yield a single unbroken piece of porcelain, reasons are so far unknown, and probably ony excavations may yield intact pieces. The identification of sherds confirms that they belong to the 16th and 17th centuries and during this time the Portuguese had a strong hold of maritime trade with Goa and her colonies. None of the sherds belong to the pre-Portuguese period. The explorations and excavations of Chandor and Gopakapatana have brought to light Chinese sherds. Chinese porcelain similar to that in Old Goa is seen even today in many houses of Goa. Comparable Chinese sherds have also been recovered from the St. Augustine Church of Old Goa. The Augustine church complex has unearthed approximately 22,000 Chinese sherds and most of them are blue on white. These are also called under-glazed cobalt blue and commonly known as 'Kraak ware'. These sherds have been classified on the basis of their design, surface treatment, symbols and inscriptions, and, about 200 sherds have been identified based on their designs and belong to large bowls, plates, pots, vases, etc. It appears that Europeans were unaware of this ceramic until the Portuguese began to sail to the Far East in the 16th century. Until this time Chinese pottery dominated the markets of Africa, Near East and Southeast Asia. Once Portuguese established contacts with China, they became the major importer of porcelain, silk, musk, camphor and alum, in return China received pepper and incense in huge quantity. Maritime trade contacts sprang up between China and Portugal and countless crates of porcelain were brought from China to Lisbon then sent to Europe. However, EDXRF, ICP-MS trace element, and, Raman spectra analysis, of these sherds would provide more information.

Acknowledgements

Authors are thankful to the Director, NIO and K.H. Vora, Scientist-in-charge, Marine Archaeology Centre for their encouragement. Our sincere thanks go to Prof. Noboru Karashima, Emeritus Professor, University of Tokya; Mr. Yoh Kanazawa, Curator of Chinese Ceramics, Idemitsu Museum of Art, Tokya; Dr. Hanae Sasaki, Kanazawa University, Japan and Bobby C. Orillaneda, National Museum of the Philippines for identifying the sherds. Thanks are also due to Satish Chitari, Ravindra Uchil Shaikh Ali Karim and Mahesh Mochemadkar for drawings and photographs. This is NIO's contribution No. 5122.

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Book Reviews

Excavations at Jhusi (Pratisthanpur)

V.D. Misra, J.N. Pal, M.C. Gupta and P.P. Joglekar
2008. New Delhi: Indian Archaeological Society

Jhusi, ancient Pratisthanpur, located on the left bank of the Ganga, opposite the *sangam* (confluence of the Ganga, Yamuna and mythical Sarasvati), is the ancestral settlement of *Prayag*, the most important pilgrimage centre (*tirtha*) of the Hindus. The *Kumbha* Fair, a gathering of over ten million devout Hindus and a large number of spectators from India and other countries is held at the *sangam at Prayag* (Allahabad) every twelve years.

The archaeological remains at the ancient site of Pratisthanpur cover an area of 4.5 km^2, making it one of the largest and well-preserved sites in the country. The major portion of the site is occupied by the present village of Jhusi. Excavations were conducted by the Department of Ancient History, Culture and Archaeology, Allahabad University for five seasons between 1995 and 2003. This revealed a habitation deposit of 16.5 m, one of the thickest in the country, and yielding an unbroken sequence of six cultures (Neolithic, Chalcolithic, Pre-NBPW with iron, NBPW, Shunga-Kushana, Gupta, and Medieval period). Besides, explorations revealed a 15 m thick alluvial deposit of the Ganga with microliths on the surface. Microliths were also found at the nearby settlements of Jamnipur and Nibi Kalan.

This excavation report consists of (a) Preface, (b) Introduction: Excavations at Jhusi: The Archaeology of the Middle Gangetic Plain by V.D. Misra, J.N. Pal, and M.C. Gupta (pp. 11-46). The introduction begins with an excellent drainage map of the region, location, significance and stratigraphy of Jhusi and prehistoric background. K.S. Saraswat and A.K. Pokharia, in their report on the botanical remains from the Neolithic deposit, presented in a well-organized tabular form, have shown that Neolithic agriculture was quite diversified. It comprised both summer and winter crops. The medicinal trees cultivated included *Emblica officinalis* (*Anwala*). According to Saraswat and Pokharia, the bulk of fruit and seed material included cereals, leguminous seeds, and oiliferous crops.

Chapter II of the volume entitled, 'The Faunal Remains Recovered from Jhusi: A Multi-Culture Site in Uttar Pradesh', is a comprehensive report on faunal remains by P.P. Joglekar (pp. 47-108). It covers archaeozoological methods, the faunal material and the species identified in various cultural phases. In a very thorough and comprehensive faunal study Joglekar has identified 44 species-7 domestic mammals, 20 wild mammals, and 16 non-mammals in the Neolithic Phase. In the faunal material from the Chalcolithic Phase only 241 (59.51%) fragments were identifiable. Many pieces were charred and had cut marks. The domestic animals included cattle, buffalo, goat, sheep and dog. Domestic pig is a new species found in this phase. As in the Neolithic period, economy during the Chalcolithic also was based on domestic species but the role of cattle and buffalo was reduced. The role of wild animals was double that in the preceding phase. They comprise wild boar, nilgai, blackbuck, chowsingha, sambar, chital, hog deer, barking deer, jackal, panther, rat, bandicoot, squirrel, domestic fowl, small-sized bird, freshwater turtle, mussel, and snake, and *Kachuga tecta* were hunted and consumed.

Like the previous phase, the proportion of domestic mammals constitutes 80% of the faunal assemblage in the Pre-NBP (with Iron) Phase with cattle being dominant.

In comparison to the previous phase, the proportion of non-mammals was 13%. Non-mammalian species included two birds, *Gallus domesticus*, and an unidentified large-sized bird, probably sarus crane, and two amphibians – saw-back turtle and Ganges softshell turtle (*Kachuga tecta)* and *Trionyx gangeticus*, three varieties of fish, namely, *Wallago attu*, *Labio rohita* and *Rita rita*, one mollusk, *Lammellidens sp.*, and one reptile, *Varanus bengalensis*.

The NBPW Phase had the thickest deposit (5.84 m), and yielded the largest quantity of faunal material. The fauna comprised eight domestic animals, namely cattle, buffalo, goat, sheep, pig, dog, horse and ass; 18 wild mammals, one reptile, namely snake, six species birds, five species of reptiles, four species of fish (*Rita rita, Catla catla, Labio rohita, Wallago attu)*, two species of molluscs, and crab.

In the Sunga-Kushana Phase the number of identifiable bones was much smaller. Yet the following species could be identified: cattle, buffalo, goat, sheep, pig and dog (domestic); The wild species comprised gaur, nilgai, chowsingha, blackbuck, chital, sambar, boar, rat, bandicoot, hare (wild mammals), turtle and two species of fish.

The analysis of the faunal material from the Gupta period deposit shows that mammals not used for food were totally absent in the collection. The proportion of domestic mammals was as large as 76% compared to the Sunga-Kushana Phase. There was only a single pig bone and none of sheep in the collection, showing negligible contribution of these animals to the food supply, probably because of the prohibition on the killing of domestic animals due to the influence of Buddhism and Jainism.

The faunal spectrum of the Early Medieval Phase was similar to that of the preceding Gupta Phase. In this phase nearly 85% of the bones belonged to domestic animals, marking the peak of the trend begun during the Neolithic. Among the domestic animals cattle and buffalo formed nearly 70% of the faunal material. The faunal material of this phase did not show much change in terms of wild mammalian utilization as compared to previous Gupta Phase. Like the previous phase, nilgai, blackbuck, chowsingha, boar, sambar and chital were hunted during the early Medieval phase.

Two other wild mammalian species, barking deer and porcupine were identified during this phase. The non-mammalian species were similar to those of the previous one. Only about 6% of the bones belonged to non-mammals.

Archaeology of the Ganga Plain: Cultural-Historical Dimensions

Purushottam Singh

2009, New Delhi: Aryan Books International & Shimla: Indian Institute of Advanced Study.

The volume is an outcome of the research project, entitled *Cultural-Historical Dimensions of Recent Archaeological Discoveries in the Middle Ganga Plain*, undertaken by the author as a Fellow of the Indian Institute of Advanced Study, Shimla. The book consists of six well-written and comprehensively documented chapters which provide us an up-to-date and refreshing review of the foundations of the evolution of technology, material culture, agricultural practices and food habits of the people living in the Ganga Plain. The author has aptly opened the book with a quotation from the distinguished archaeologist, Sir Mortimer Wheeler, stating that while the Indus gave India her name, the Ganga has given her faith and the social system with the much maligned caste as its bedrock. While the system has no doubt outlived its utility, during the period of four millennia when it evolved, it performed the unique role of integrating one-fifth of humanity belonging to diverse and, often contrasting, biological, linguistic and occupational categories, practicing different food habits, social customs, religious beliefs and practices. The author has provided succinctly written reviews of geomorphological, palaeoclimatic, archaeological, archaeozoological, archaeobotanical, and chronological history of the Ganga Valley.

Chapter 1 provides a summary of the history of archaeological research, excavation of Early Historic urban sites, discovery of Neolithic-Chalcolithic foundations of Early Historic cities, recent explorations in the Saryupar Plain and Chalcolithic sites in the Lower Ganga Valley. Chapter 2 provides geographical background of the Upper, Middle and Lower sections of the Ganga Plain, drainage, rainfall, crops, stone tool assemblage of the Upper Pleistocene deposits of the Yamuna. Chapter 3 describes the Epi-Palaeolithic and Mesolithic cultures of the Ganga Valley, burial practices, and biological composition of the people. Chapter 4 deals with the Neolithic background of the Ganga Civilization provided by the excavations at Koldihwa, Mahagara, Pachoh and Tokwa on the Vindhyan plateau, and Jhusi and Hetapatti in the Ganga Valley. Chapter 5 gives summaries of the findings of the excavations of Chalcolithic sites of Sohgaura, Narhan, Bhunadih, Waina, Khairadih, Chirand, Taradih, Senuwar, Champa, Manjhi, Raja Nal Ka Tila, Agiabir, Malhar, Tokwa, Jhusi and Sringaverpura. Finally, Chapter 6 gives an excellent reconstruction of the material culture and social formations during Neolithic-Chalcolithic periods in respect of settlement pattern, farming and pastoralism. It also discusses the domestication of animals, development of archaeozoological studies in India, pottery, emerging picture, and Chalcolithic metal technology. In short the book provides an excellent account of the Protohistoric cultural evolution in the Middle Ganga Valley. Unlike many recent archaeology publications this book is written in flawless English, and is illustrated by excellently drawn maps and drawings of plans and sections of excavations, and pottery and material objects, by beautiful colour photographs of sites, excavations, pottery, metal objects and other objects of material culture. Seven appendices of radiocarbon dates from the sites excavated sites of Koldihwa, Lahuradewa, Raja-Nal-Ka-Tila, Senuwar, Jhusi, Khairadih, Narhan, Sohgaura, Chirand, Mahadaha, Sarai Nahar Rai, Tokwa, Malhar, Dadupur, Agiabir and Aktha considerably augment the value of the for understanding the process of cultural evolution.

India's First Farmers

Ranjit Pratap Singh
2010. Varanasi: Kala Prakashan

From about 1960 Indian archaeologists began to realize the value of organic materials for reconstructing the environment and culture of the past and started collecting plant and animal remains from the sites they were investigating. Initially, the collections were selective, limited, and confined to macro remains, mainly of animals. These the archaeologists would pass on to interested zoologists for study and analysis. Plant remains, being less hardy, were rarely preserved unless they happened to get charred. In due course archaeologists devised special methods and techniques like dry and wet sieving and floatation for the retrieval of micro objects. Since the work at the Chalcolithic site of Ahar in Udaipur district, Rajasthan in 1961, several scholars have identified botanical specimens from a large number of archaeological sites. These identifications have produced a large database of protohistoric and ancient Indian agriculture. However, it is scattered in numerous excavation reports and research papers in many journals. Dr. Ranjit Pratap Singh has produced a synthesis of this data providing a comprehensive picture of early Indian agriculture. In addition to his synthesis he has given vernacular and Latin names of all ancient crops which will be very useful to young scholars. The author has given details of references at the end of every chapter and a comprehensive bibliography at the end of the book. In addition, he has given black-and-white photographs of ancient crop seeds and colour pictures of a number of modern crop plants. As there is no book on protohistoric and Early Historic agriculture, Singh's book and will be useful to all students of archaeology and ancient history.

However, there are a few shortcomings including the title of the book. The title itself is a misnomer because agriculture consists of both plant cultivation and stock-breeding while the book deals only with plant agriculture. Second, too much space has been devoted to references. Despite these drawbacks the book is a useful contribution to Indian archaeology.

Urbanization of the Middle Ganga Plain

Santosh Kumar Singh
2010. New Delhi: Rishi Publications

This volume on the urbanization of the Middle Ganga Plain is of small size but a large format. It covers the area from the western border of Uttar Pradesh to the junction of the Ganga and the Gandak in eastern Uttar Pradesh. This book consists of five chapters. Chapter I (Introduction) briefly discusses the concept and diagnostic traits of urbanization, makes a short survey of published literature on urbanization, and gives an introduction to the geographical background of the region, comprising physical divisions, drainage system and soils. Chapter II makes a review of Pre-Urban settlements of the Middle Ganga Plain. This is followed by a discussion of the urban settlements of the Middle Ganga Plain. These comprise Kausambi, Sravasti, Ganwaria-Piprahwa/Tillaurakot, Rajghat, Vaisali, Pataliputra, Champa, Rajgir, and Sonepur. Chapter IV discusses findings of newly discovered and excavated settlements of the Middle Ganga Plain

(Agiabir, Jhusi and Nindaur). Chapter V discusses the role of iron technology in the growth of urban centres, and gives radiocarbon dates of Malhar, Raja Nal-Ka-Tila, Jhusi, and the Ganga Plain and the Eastern Vindhyas. This is accompanied by bibliography and 27 photographs of excavated trenches and objects.

The Pre-Urban settlements of the Middle Ganga Plain are located between the Ganga River in the south and the Gandak in the north. A few settlements, like Malhar, Koldihwa, Senuwar and Raja-Nala-Ka-Tila, however, occur on the hilly and rocky terrain, south of the Ganga, and a few to the east of the Son River, north of the Chhota Nagpur Plateau. While a couple of settlements like Vaishali, Chechar and Champa, occur to the east of the Gandak, the principal concentration is between the Vindhyan Plateau in the south and the Gandak river in the northeast and Chota Nagpur in the south and the Ghaghara or Saryu river in the north. However, some settlements also occur between the Ghaghara and the Gandak River. Gorakhpur city, an important centre of the Shakti cult, is, with the exception of Sravasti, the northern limit of permanent settlements. Only one settlement, namely Champa, is located south of the Ganga River and far to the west of Rajgir. The map of the region clearly shows that the Siwalik Hills in the north and the Chota Nagpur Plateau in the south set the limits of the agriculture-based permanent settlements. While the fertile Ganga Plain was a source of agricultural surplus, so essential for sustenance of urban centres, the mineral rich Chota Nagpur provided the mineral resources like iron and copper ores and coal for their smelting and processing.

Unlike many recent archaeology publications this book is written largely in flawless language and is printed on art paper. It makes a valuable contribution to understanding the process of urbanization in the Middle Ganga plain which was the arena of the activities of Rama, one of important incarnations of Vishnu, and of Gautam Buddha and Mahavira who deeply impacted, and continue to impact, the lives of many millions of Indians.

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Obituary

Malti Nagar

07.04.1934-10.09.2011

Malti Nagar, former Reader in Asian Archaeology in the Deccan College, Pune passed away after a brief illness on 10 September, 2011.

Malti Nagar came to Pune in 1962 after passing her M.A. in Anthropology twice, first in 1958, with specialization in Social Anthropology, and second time in 1961, with specialization in Prehistoric Archaeology.

Malti Nagar registered for Ph.D. on the topic Ethnoarchaeology of the Ahar Culture. Her doctoral work mainly consisted of a comparative study of Chalcolithic pottery, architecture, metal work and folk religion with contemporary life, present-day pottery, dress and ornament making and folk religion. She made a comparative study of the painted designs on Black-and-White pottery of the Ahar Culture, and those on the *odhnis* of the Bhil and other women working in the excavation at the site of Ahar. She also studied the architecture of the Chalcolithic Ahar and rural Mewar, and noted many similarities between the materials and techniques used, as also of copper ornaments used by Chalcolithic women and those made of brass and bell metal used by the rural women of Mewar, both produced by *cire perdue* or lost wax technique. While doing research for her Ph.D. Malti Nagar made a detailed study of the folk religion of Mewar. The religion consists of the worship of numerous gods and goddesses who are not just divinities, but are active participants in the life of their devotees, blessing them with material prosperity and good health. Malti Nagar got her Ph.D. in 1966 and was appointed as a Research Assistant in the Archaeology Department. In 1967 she was appointed as a Lecturer in Ethnoarchaeology, the first such position to be created in any Indian University Department.

After becoming a faculty member, Dr. Nagar worked among the Gonds and other tribes living around the Bhimbetka cave and rock-shelter complex in Sehore District, and studied various facets of the culture of the tribal people of the Bastar district of former M.P. and present-day Chhattisgarh State. She also did research on the megalithic burials and associated rituals of Maria Gonds in Bastar. Besides, she carried out important work on the folk religion and pottery making techniques used by the Chalcolithic potters and present-day potters living around tribal villages. In particular, she studied the pottery making techniques in Gogunda tribal village, located in the Aravalli Hills, close to Chawand, the birthplace of Maharana Pratap. She made a detailed study of pottery shapes, decorations, functions and manufacturing techniques in this and surrounding villages.

Dr. Nagar's major work after getting her Ph.D. was on hunting, trapping and fishing practices and technology used by the the Kanjars of Farrukhabad district in U.P, Pardhis and Kuchandhias in Sagar, Damoh and Samnapur districts of M.P. as also of fishing and plant food-gathering practices and tools and weapons like spears, nets and traps, used by the tribal people. She had a knack of befriending rural and tribal women in getting useful ethnographic information from them. Dr. Nagar also carried out fieldwork among the Maria and Muria Gonds of Bastar district. Her main contribution was on the collection of wild plant foods, disposal of the dead, and erection of wooden, stone and cement concrete memorials to the dead. Nagar collected valuable data on these aspects, and published several papers. She collaborated with me in the classification of a large volume of microliths from the sites of Bagor and Tilwara in Rajasthan and in developing a comprehensive typology of microliths and associated tools. This typology is useful to all researchers.

One of Dr. Nagar's major interests was in ethnomedicine. She was an active member of the ethnomedical Society, Lucknow, and was a member of its Executive Committee. She was a Life and executive Committee member of several other Societies like the Ethnographic and Folk Culture Society, Lucknow, Indian Society for Prehistoric and Quaternary Studies (ISPQS), Pune, and Indian Archaeological Society (IAS) and Indian History and Culture Society (IHCS), New Delhi. She was very keen on attending the joint annual conferences of the ISPQS, IAS and IHCS.

She has published over 20 articles in journals and edited volumes besides a monograph on ethnorchaeological studies in North and Central India, the last published in the British Archaeological Reports (BAR) series from Oxford.

Malti guided Gita Doshi in her Ph.D. research on an ethnoarchaeological study of Protohistoric ceramics of Gujarat. She was extremely conscious of her commitment to Ethnoarchaeology and instituted two awards, one for the student who secured the highest marks in the paper on Ethnoarchaeology in the M.A. Examination in Archaeology conducted by the Deccan College and the other for the best paper in Ethnoarchaeology presented during the joint Annual conference of ISPQS, IAS and IHCS.

As a person Dr. Malti Nagar was extremely gentle and caring. She was devoted to her friends, students and relatives. She had a large number of friends in Deccan College, other institutions, and outside archaeology. She was good in Hindi and Urdu poetry and often used to recite poems. Because of her commitment to Archaeology in general, and ethnoarchaeology in particular, and for her friendly, endearing and caring nature Dr. Nagar will be remembered by her students, colleagues, and relatives for many years to come.

List of Select Publications

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Nagar, Malti 1982. Fishing among the Tribal Communities of Bastar and its Implications for Archaeology, *Bulletin of the Deccan College Research Institute* 41: 116- 125.

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Nagar, Malti and S. Nagaraju 1986. Ethnographic Evidence for the Location of Ravana's Lanka, *Bulletin of the Deccan College Research Institute* 46: 71-77.

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Nagar, Malti and V.N. Misra 1993. The Pardhis: a Hunting-gathering Community of Central and Western India, *Man and Environment* XVIII(1): 115-144.

Nagar, Malti and V.N. Misra 1994. Survival of the Hunting- gathering Tradition in the Ganga Plains and Central India, in *Living Traditions* (Bridget Allchin Ed.), pp. 169-192. New Delhi: Oxford and IBH.

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Report of the General Secretary for 2010-2011

(01-04-2010 to 31-03-2011)

Like previous years, functioning of the Society during this year ending on 31-3-2011 has been satisfactory, both academically and financially. The regular activities of the Society were carried out successfully. We are grateful to the Indian Council of Historical Research (ICHR) and the Archaeological Survey of India (ASI) for financial support for both publication of the Society's Journal *Man and Environment* and for organizing the annual conference. The audited statement of accounts for the period ending 31-3-2011 is printed in this Volume (XXXVI, No. 2).

Man and Environment

The Journal continues to attract a wide range of manuscripts by scholars from within and outside the country. The circulation of the journal is slowly, but steadily increasing. The editors are constantly trying to enhance its quality. We thank all our referees for giving support, reading the articles and making positive suggestions to the authors. We sincerely thank Mr. Sujit Patwardhan and his staff at Mudra Press, Pune for their excellent cooperation in the production of the journal.

The Presidential Address of the Society delivered by Professor Vidula Jaiswal at Allahabad has been published in the June issue of Volume XXXV (2010). Prof. V.N. Misra's Eighth Professor H.D. Sankalia Memorial Lecture (read out *in absentia*) has been published in the June 2011 issue of the Journal (Volume XXXVI, No. 1).

New Life Members

A total of 43 persons joined the family of life members of the Society during 2010-2011:

Andre Jude Joseph Baptista, Amardeep T. Barsagade, Avick Biswas, Prinyaka Chandra, Gargi Chatterjee, Ekta Dharkar, Neha Dhavale, Indrajeet Dutta, Kishor Gaikwad, Smita S. Geedh, Sachin Gupta, Ankush Hate, Shreyas Jagtap, Gopal Joge, Jayendra Joglekar, Sachin Joshi, Kanika Kalra, Kanchani Prova Koch, Anil Kumar, Karna Kumar, Virendra Kumar, Laishram Kunjeshwori Devi, G.K. Lama, Vrushab Mahesh, Arun Malat, Debanjan Mitra, Debasis Kumar Mondal, Avradeep Munshi, Sneha Nagarkar, Naina Pandey, Arunima Pati, Maya Patil-Shahpurkar, Kailash Pawar, V.P. Remya, Jayanta Singh Roy, Tejal Ruikar , Amrita Sarkar, Soumi Sengupta, Ravi Shankar, Rewant Vikram Singh, Uduwila Uparathna, Ruta R. Waghmare and Subhash Chandra Yadav.

Minutes of the Meetings of the Executive Committee

(1) The first meeting of the new Executive Committee of the Society (2010-2013) in the year 2010-2011 was held at 4-00 p.m. on Friday 30th July 2010 at the residence of Prof. V.N. Misra (Pune). Dr. P.K. Thomas, Chairman of the Society presided over the meeting. The following transaction took place according to the agenda:

Item No. 1: Chairman of the Society welcomed all the new members of the Executive Committee for 2010-2013.

Item No. 2: Prof. D.P. Tewari's invitation of holding the Annual Conference in 2010 at Lucknow was discussed and accepted.

Item No. 3: The treasurer suggested that the Life Membership fees be increased from current ₹ 3000 to ₹ 5000. After discussion this suggestion was accepted. It was resolved that the Life Membership fees shall be ₹ 5000 from 1-4-2011

Item No. 4: Dr. P.P. Joglekar, Joint Editor of the Journal suggested that the price of the journal be increased to ₹ 1000. After discussion it was resolved that the price of each issue of the journal shall continue to be ₹ 800 till volume XXXVI (No. 2) since the Society has already accepted orders from book sellers at this price. Therefore, it was further resolved that the price of each issue of the Journal shall be ₹ 1000 from volume XXXVII (No. 1) of 2012.

Item No. 5: It was resolved to appoint a sub-committee of Drs. Shanti Pappu and S.G. Deo to take necessary steps to develop the society's website and authorized them to explore the possibility of hosting a website and suggest how much fund would be required.

The meeting ended with the vote of thanks proposed by the Assistant Secretary.

(2) The General Secretary felt that there was no suitable time to hold a meeting of the Executive Committee before Lucknow Conference, all the members of the EC were contacted through e-mail on 1-12-2010 and their suggestions and opinions were solicited regarding following points:

1. Selecting the President for the year 2010-11.
2. Selecting a scholar to deliver Prof. H.D. Sankalia Memorial Lecture in 2011
3. Selecting a scholar to confer upon the R.K. Sharma Award in 2011.

All the members unanimously accepted following decisions suggested by the General Secretary (seconded by Prof. V.N. Misra).

1. Prof. H.D. Sankalia Memorial Lecture in 2011 to be delivered by Dr. Gautam Sengupta, DG, ASI
2. Prof. K.K. Basa to be the President for 2011
3. R.K. Sharma Award for 2011 to be conferred upon Prof. A. Sundara.

(3) The meeting of the Executive Committee took place at Lucknow University on the 29th of December 2010 at 2-30 pm in the premises of the Department of Ancient History & Archaeology, University of Lucknow. P.P. Joglekar, General Secretary presided over the meeting. The following transaction took place according to the agenda:

Item No. 1: The minutes of the last EC meeting held on 30th July 2010 were read and confirmed.

Item No. 2: The decisions taken by the General Secretary after soliciting suggestions and opinions through e-mail (letter dated 1st December 2010) were approved and included in the agenda of the Annual General Body Meeting in December 2010.

Item No. 3: Report submitted by the General Secretary for 2009-2010 was discussed and approved for inclusion in the agenda of the Annual General Body Meeting in December 2010.

Item No. 4: The audited statement of accounts submitted by the Treasurer for 2009-2010 was discussed and approved for inclusion in the agenda of the Annual General Body Meeting in December 2010.

Item No. 5: After the suggestions made by the Assistant Secretary about new Life Members to be accepted, it was resolved that scholars can apply for Life Membership and EC will take a decision on case by case basis, and only those accepted will pay the subscription.

Item No. 6: The Treasurer pointed out that several members have not paid their dues till December 2010 in spite of repeated appeals. It was resolved that such members will not be considered as Life Members, until they clear their dues. Those who fail to clear their dues till 31st March 2011 shall have to pay the enhanced subscription, i.e. ₹ 5000/- from 1st of April 2011. Such members would get all the benefits of the life membership only after clearing their dues.

Meeting of the General Body of the Society

The Annual General Body meeting of the Society was held on the 29th of December, 2010 in the premises of the Department of Ancient History & Archaeology, University of Lucknow, at 6.00 pm. The meeting was presided over by P.P. Joglekar.

At the outset, the General Secretary, welcomed the members and presented the report of the activities of the Society for the year 2009-2010. The members of the Society unanimously approved it. The Treasurer placed the Annual Audited Statement of the Accounts for the year 2009-2010 before the General Body, and members present at that time unanimously approved it.

The General Secretary apprised the General Body of the decisions taken in the meetings of the Executive Committee of the Society in the current year. After discussion all the decisions of the Executive Committee were unanimously ratified. The General Body thanked Prof. D.P. Tewari and the Lucknow University for successfully hosting the conference.

Many members of the General Body expressed concern that we do not have a website. The members were informed about the steps taken to make the website operational in 2011. The report of sub-committee comprising Drs. Shanti Pappu and S.G. Deo appointed to explore the possibility of hosting a website and make suggestion about the financial requirement has been accepted. The fund necessary for this work shall be made available in the next financial year (2011-2012).

General Secretary informed the members that the Indian Council of Historical Research (ICHR) has sanctioned the grant for holding the conference in 2010. The members present at that time unanimously joined in thanking the ICHR for the generous grant and expressed hope that the Council would continue to give such financial support. Also, the Archaeological Survey of India (ASI) has been kindly supporting the publication of the journal. The General Body resolved to thank the ASI for the support. The General Body passed a resolution thanking Shri K.N. Diskshit for his constant efforts in keeping alive the spirit of close co-operation among the three societies.

Annual Conference

The 38th Annual Conference was held, in conjunction with the 44th Annual Conference of the Indian Archaeological Society and 34th Annual Conference of the Indian History and Culture Society between 28th and 30th December 2010 at the Department of Ancient Indian History & Archaeology, Lucknow University, Lucknow. Over 170 life members of the Society participated in the conference.

The Joint Annual Conference of the three societies – IAS, ISPQS and IHCS on the 28th of December 2010 began with welcome speech by Prof. D.P. Tewari, Convener of the Joint Conference and the head of the Department of Ancient Indian History and Archaeology. Prof. M.K. Mishra, Vice-Chancellor of the Lucknow University inaugurated the Joint Conference. Shri Lalji Tandon, Member of Parliament was the chief guest of the function. Prof. R.P. Singh, Vice-Chancellor of the Lucknow University, Prof. Dinesh Sharma, Mayor of Lucknow and Shri R. Jakhmi, Vice-President of the International Research Institute of Buddhist Studies, Lucknow shared their views with the audience.

Presidential Address

The Presidential Address of the Society was delivered by Dr. Rakesh Tewari, Director of the UP State Department of Archaeology. The title of the address was 'Given another life....". The full text of this address has been published in Volume XXXVI(1).

Professor H.D. Sankalia Memorial Lecture

The Ninth Professor H.D. Sankalia Memorial Lecture was delivered by Prof. K. Paddayya, former director of the Deccan College, Pune. The title of his lecture was "Newer Perspectives in the Investigation of Early Agro-pastoral Cultures of India". The full text of this lecture is published in this issue of the Journal.

The Academic Sessions

The academic sessions of the conference were held on the 28th, 29th and 30th December 2010 and the 37 papers were presented in addition to 4 poster presentations.

12-12-2011 **General Secretary**
(P.P. Joglekar)

THE BOMBAY PUBLIC TRUST ACT, 1950. – SCHEDULE IX (VIDE RULE 17(1)

Indian Society for Prehistoric and Quaterenary Studies

c/o. Department of Archaeology, Deccan College, Pune 411006

BALANCE SHEET AS ON 31st MARCH, 2011

Funds & Liabilities	Rs.	Rs.	Property & Assets	Rs.	Rs.
Trust Funds or Corpus			**Immovable Properties (Net of Depreciation)**		
Bal. as per prev. B/S.			- Computer Systems	1,339.92	
Adjustment during the year	659,828.52		- Cupboards	5,616.24	
(Donations recd. during the year)	00.00	659,828.52	- Dead Stock	519.23	
			- Fan Purchase	140.06	
			- Furniture & Fixture	9,508.11	
			- Scanner	784.00	17,907.56
(Created under the provisions			(As per Schedule)		
of the trust deed income)					
- Depreciation Fund			Investments		2,424,106.21
- Other Earmaked Funds	83,607.95		(As per Schedule II)		
- Reserve Fund	1,835,182.16	2,008,920.99			
			Other Movable Properties		0.00
For Expenses	0.00		Current Assets		
Other Deposits	0.00		- Sundry Debtors	12,085.00	
Audit fee PROVISION FOR	3,720.00		- TDS on FD	22,487.00	34,572.00
Amt Payable	0.00				
Sundry Creditors	72,072.00	75,792.00	Cash & Bank Balances		
Other Liabilities	788.94		- Cash	35.77	
			- Bank Balances	267,919.97	267,955.74
Income & Expenditure A/c.					
Bal. as per prev. B/S.	0.00		Income & Expenditure A/c.		
Less: Appropriation if any	0.00		Bal. as per prev. B/S.		
Add: Surplus of Inc & Exp A/c	90,130.88		Add: Deficit for the year		
Less: Trf to General Reserves	(90,130.88)				
Total Rs.		**2,744,541.51**	**Total Rs.**		**2,744,541.51**

As per our report of even date

	Sd/-	Sd/-	Sd/-
For A.G. OGALE & ASSOCIATES	P.P. Joglekar	Shanti Pappu	S.G. Deo
Chartered Accountants	*General Secretary*	*Joint Secretary*	*Treasurer*

Sd/-
(A.S. CHANDVANKAR)
Partner
M No.: 043811.

Place: Pune
Date: 31-07-2011

THE BOMBAY PUBLIC TRUST ACT, 1950. – SCHEDULE IX (VIDE RULE 17(1)

Indian Society for Prehistoric and Quaterenary Studies

c/o. Department of Archaeology, Deccan College, Pune 411006

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH, 2011

Expenditure	**Rs.**	**Rs.**	**Income**	**Rs.**	**Rs.**
To Expenditure in respect of			By Rent (accrued)/(realised)		0.00
- Repairs & Maintenance	0.00	0.00			
			By Interest (accrued)/(realised)		
To Expenses on the object			- On Deposits (FD)	82,641.18	
of the trust			- On Bank Account	12,814.00	95,455.18
(as per Schedule – A)					
- Conference Expenses	63,443.00		By Grant Recd. – ICHR		6,000.00
- Publication Expenses	253,667.00				
- Other Expenses	9,811.30	326,921.30	By Publication Grant – ASI		0.00
To Contribution and Fees		0.00	By Seminar Grant Recd. from ICHR		0.00
To Depreciation		4,973.00	By Cost of Monographs – DHP etc.		7,800.00
To Surplus carried over to B/S.		90,130.88	By Life Membership Fees		155,300.00
			By Sale of M & E Volume		157,470.00
			By Deficit carried over to B/S.		
Total Rs.		**422,025.18**	**Total Rs.**		**422,025.18**

As per our report of even date

For A.G. OGALE & ASSOCIATES *Chartered Accountants*	Sd/- P.P. Joglekar *General Secretary*	Sd/- Shanti Pappu *Joint Secretary*	Sd/- S.G. Deo *Treasurer*

Sd/-
(A.S. CHANDVANKAR)
Partner
M No.: 043811.

Place: Pune
Date: 31-07-2011

CHEMISTRY
PHYSICS

Inauguration of the Joint Annual Conference at Lucknow, 2010

INTERNATIONAL CONFERENCE
Special Seminars on
Recent Archaeological Achievements in India & Facets of Buddhism
CHEMISTRY
BOTANY

Joint Annual Conference at Lucknow, 2010:
Inaugural function in progress

BOTANY
Recent Archa

Professor K. Paddayya delivering the
Professor H.D. Sankalia Memorial Lecture, 2010

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Publisher
Indian Society for Prehistoric and Quaternary Studies
c/o Department of Archaeology
Deccan College, Pune 411006

Printer
Mudra
383 Narayan Peth,
Pune 411030

Price: Rs. 800.00